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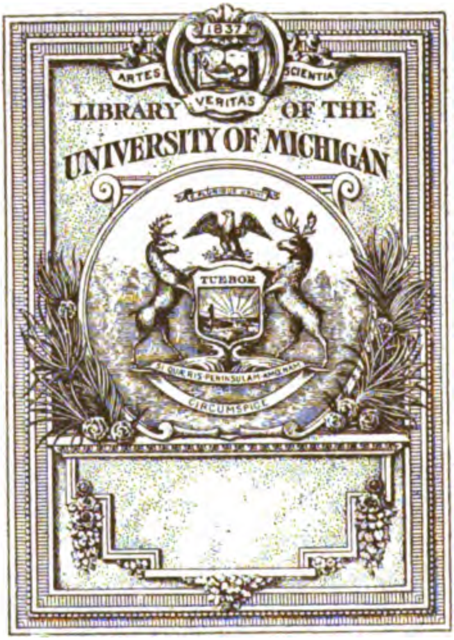
WEST VIRGINIA
GEOLOGICAL SURVEY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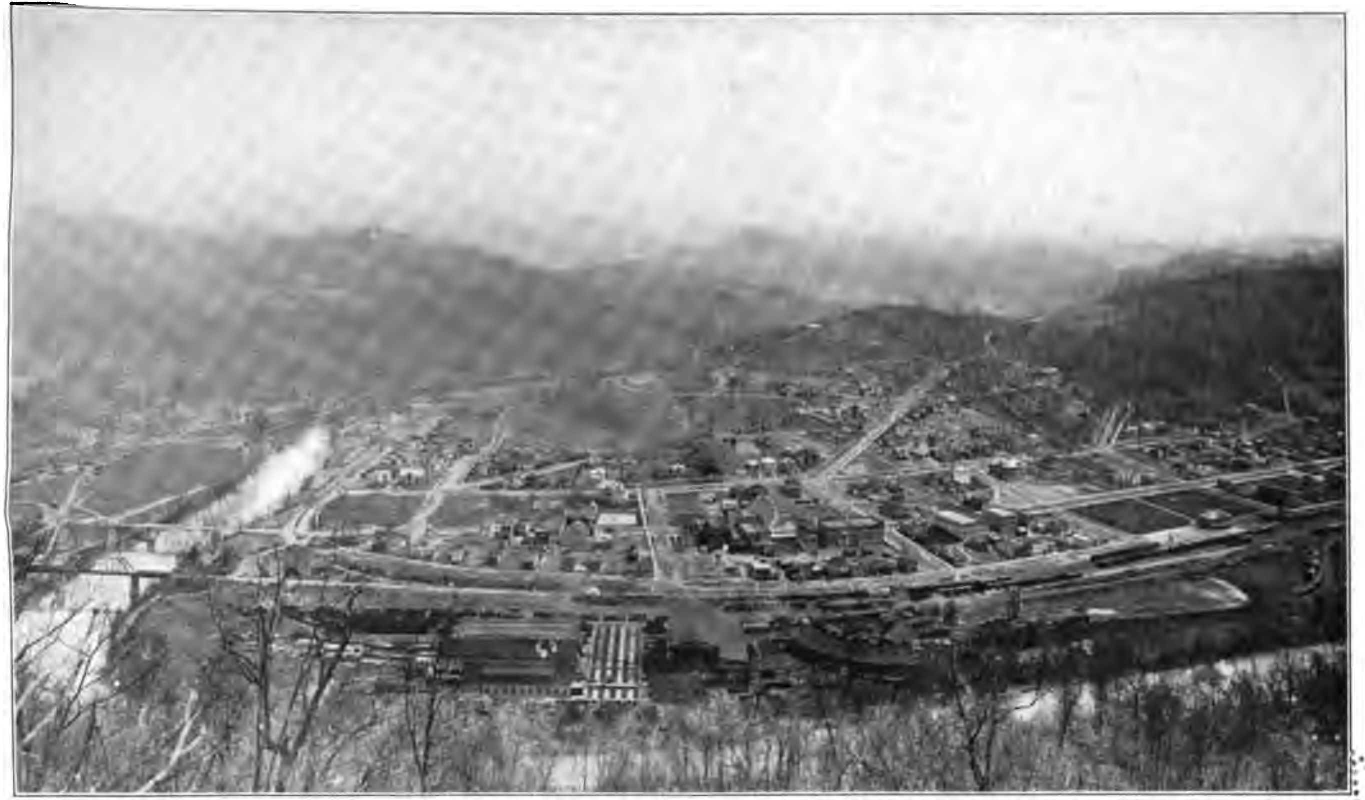

PLATE I.—Showing town of Gassaway on Elk River looking southeast, and topography of Monongahela and Conemaugh Series, Coal and Coke Railway shops in foreground.

WEST VIRGINIA
GEOLOGICAL SURVEY

JUNE 20 1863

Braxton and Clay Counties

By

RAY V. HENNEN, Assistant Geologist.

Aided in Field by

ROBERT M. GAWTHROP, Field Assistant

I. C. WHITE, State Geologist.

WHEELING NEWS LITHO. CO.
WHEELING, W. VA.
1917

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RAY V. HENNEN	*Assistant Geologist*
DAVID B. REGER	*Assistant Geologist*
W. ARMSTRONG PRICE	*Paleontologist*
ROBERT M. GAWTHROP (to Nov. 15, 1915)	*Field Assistant*
D. D. TEETS, JR. (to Sept. 15, 1916)	*Field Assistant*
BERT H. HITE	*Chief Chemist*
JAN B. KRAK	*Assistant Chemist*
J. LEWIS WILLIAMS	*Chief Clerk*
RIETZ C. TUCKER	*Engineer and Stenographer*

LETTER OF TRANSMITTAL.

To His Excellency, Hon. John J. Cornwell, Governor of West Virginia, and President of the West Virginia Geological Survey Commission:

SIR: I have the honor to transmit herewith the Detailed Report and the Topographic and Geologic Maps covering the Counties of Braxton and Clay.

This important Report, the largest yet published by the West Virginia Geological Survey as a separate volume, is the work of Assistant Ray V. Hennen, aided by Robert M. Gawthrop in the field studies and assisted by R. C. Tucker of the office staff in the preparation of the data for publication, proof-reading, etc. D. D. Teets, Jr., also assisted in preparation of the data, doing most of the drafting of the geologic map as well as tabulating work, etc. This volume and accompanying maps contain a vast wealth of useful data on the economic resources of these two counties and, like all of the Reports prepared by Mr. Hennen, is a mine of accurate information systematically arranged and easily found by the reader through the comprehensive index prepared by R. C. Tucker.

The data for this publication were collected during the field season of 1915 and the volume should have been issued in 1916, but no appropriations were available for the purpose until July 1st, 1917. The same is true of the volume on Barbour and Upshur and western Randolph, the data for which were collected the same year (1915) by Assistant D. B. Reger, aided by D. D. Teets. This manuscript has just been sent to the printers, while two other volumes of County Reports and Maps; viz, that on Fayette County, and the one on Webster County, are in advanced stages of preparation, and will be ready to submit for publication early in 1918, or as soon as the appropriations for 1918 are available. The Soil studies for Braxton and Clay were completed in 1916 by Mr. W. J. Latimer, the expert of the U. S. Bureau of Soils, and his Report and accompanying Soil Map will soon be published by the U. S. Department of Agriculture with which the West Virginia Geological Survey cooperates in the soil work, paying the field expenses of the expert, while the U. S. Bureau of Soils pays the salary and the cost of preparation of the Report and Soil Map. An edition of 2,500 copies of each Soil Report and accompanying Map is sold to the West Virginia Geological Survey at cost, and a copy of same will be distributed to all who receive the geological volume.

Aside from their soils, the principal mineral wealth of these two counties is in their deposits of oil and gas, coal, building stone, clay and shales for brick-making. This volume describes in detail the mineral possibilities of every magisterial District of the two counties, and also contains an estimate of the total coal tonnage in the entire area, including that below water-level as well as that cropping in the hills. The geologic structure depicted by the contours of prominent coal beds, and also the anticlines and synclines shown upon the geologic maps, will prove of great aid to those exploiting for these valuable minerals.

I. C. WHITE, *State Geologist.*

Morgantown, W. Va., October 1, 1917.

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AUTHOR'S PREFACE.

This volume, as shown in the Table of Contents, is divided into four parts, as follows: **Part I**—History and Physiography, Chapters I and II; **Part II**—Geology, Structural and Stratigraphical, Chapters III to VIII, inclusive; **Part III**—Mineral Resources, Chapters IX to XI, inclusive; and **Part IV**—The Winifrede Limestone Fossils at Palmer and the Uffington Shale of Northern West Virginia—Absence of Marine Fauna, by W. Armstrong Price, Paleontologist, and Notes on the Possible Evidence of the Presence of a Pareiasaurus-like Reptile in the Conemaugh Series of West Virginia, by **Prof.** E. C. Case, and Note by I. C. White, State Geologist. Four maps accompany the Report in a separate atlas; viz, Map 1 of each County, showing Topography; and Map II of each County, the General and Economic Geology. The latter also exhibits the structure or inclination of the strata by two sets of contours 25 feet apart, those in **green** showing the approximate elevation above sea-level of the base of the Pittsburgh Coal, and those in **red**, the same for Upper Kittanning Coal. In addition to these separate maps, there are 15 Figures and 29 Plates embodied in the book.

In Chapter III on Structure attention is called to the tables of intervals from the coals last mentioned and other members of the rock column, a liberal use of which in conjunction with the structure contours on Map II enables one to determine the approximate elevation above sea-level of coals and other members designated in the tables in question. Attention is also called to the fact that the Chestnut Ridge and Warfield Anticlines join up, thus representing one and the same fold.

In order to describe the oil and gas sands and the several coal beds in their proper stratigraphic sequence, it was found necessary to make a large number of sections of both the surface and underground strata, these being mostly embodied in Chapter IV. This matter will be of special interest to the engineer, geologist, or coal, oil and gas operators interested in the development of the several fields.

The development of the petroleum and natural gas fields has

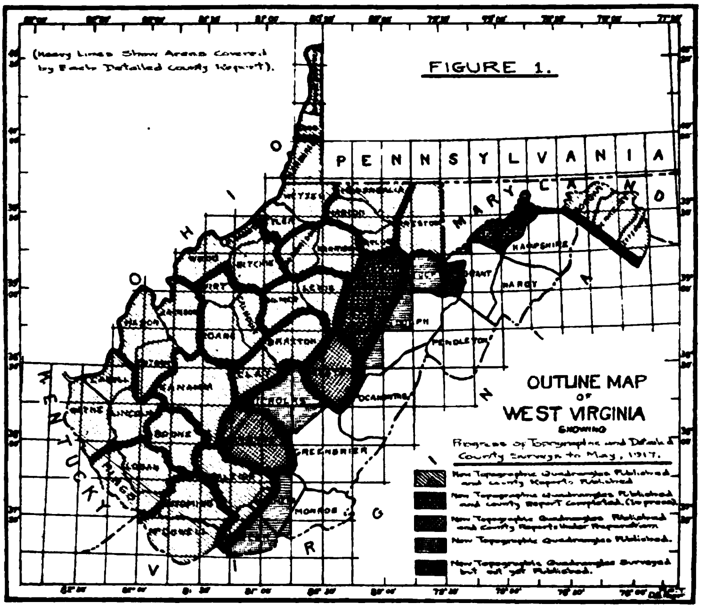
(Heavy Lines Show Areas Covered by Each Detailed County Report).
FIGURE 1.
PENNSYLVANIA
MARYLAND
OHIO
KENTUCKY
VIRGINIA
WETZEL
MONONGALIA
MARION
PRESTON
HAMPSHIRE
GRANT
HARDY
PENDLETON
TYLER
WOOD
RITCHIE
WIRT
CALHOUN
LEWIS
ROANE
BRAXTON
MASON
JACKSON
CABELL
KANAWHA
WAYNE
LINCOLN
NICHOLAS
POCAHONTAS
BOONE
GREENBRIER
LOGAN
MINGO
RALEIGH
WYOMING
McDOWELL
MONROE
OUTLINE MAP OF WEST VIRGINIA SHOWING
Progress of Topographic and Detailed County Surveys to May, 1917.
New Topographic Quadrangles Published and County Reports Published
New Topographic Quadrangles Published and County Report Completed (In press).
New Topographic Quadrangles Published and County Reports Under Preparation.
New Topographic Quadrangles Published.
New Topographic Quadrangles Surveyed but not yet Published.

Figure 1—See explanation on figure.

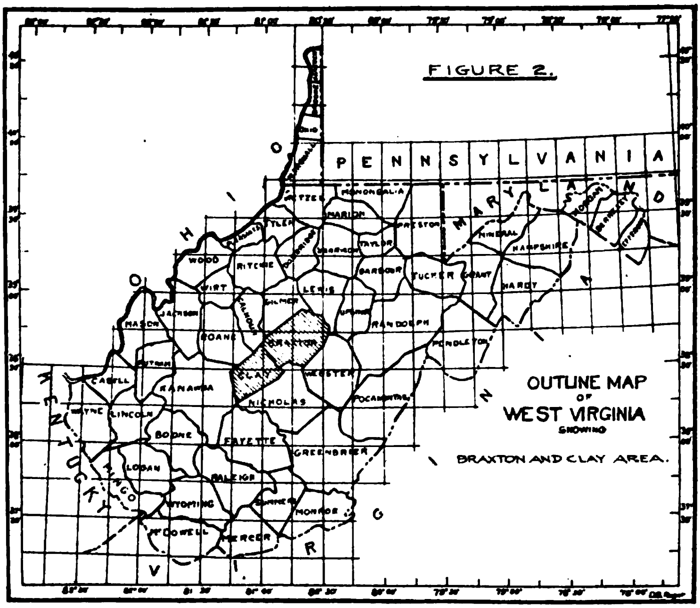

Figure 2—See explanation on figure.

been quite active during the last 4 or 5 years, a description of which is given in Chapter IX. All the oil and gas producing wells and dry holes are shown on Map II, of which 274 are listed by the same serial number from 1 to 246, both on the latter map and in Chapter IX. In the latter special attention is called to **Prospective Oil and Gas Territory** by magisterial dsitricts and page references in the Index under that heading.

In Chapter X a description is given of the minable coals along with that for a large number of openings. prospects, and mines, designated consecutively both on Map II and in the text from 1 to 966. The description of any one of these openings may be found in the text by reference to the heading in the Index: "Mines, Coal, by Numbers," where all these numbers are arranged in consecutive order. Should information be desired on the coal in any particular region, then the reader is referred to the heading in the Index: "Minable Coals by Magisterial Districts." Figures 4 to 15 inclusive, published in the same Chapter (X), show at a glance the regions in which the several coal beds are believed to attain minable thickness and purity. As some of these seams are too thin or impure in certain localities to be minable, it has been found necessary on many of the figures to establish arbitrary lines of disappearance, but it must be kept in mind that there are probably small areas of good coal just across this line in regions indicated as barren, and likewise patches within the shaded areas where the coal is thin and worthless. Such a representation can show only the **approximate line of disappearance,** and in regions where there is doubt, the data given in the text should be consulted freely for the character of the bed in question.

The author, in company with R. M. Gawthrop, Field Assistant, spent the field season of 1915 in gathering the material for this Report. D. D. Teets, Jr., and R. C. Tucker assisted in the office work, doing most of the drafting and arranging most of the tabular matter, while at the same time assisting in similar work on another Report of the State Survey.

The chemical analyses and calorific tests, except a few taken from previous Reports of the Survey and other sources, were made by J. B. Krak, Assistant Chemist, under the direction and assistance of B. H. Hite, Chief Chemist. The chemical results are not so numerous and complete as in former Reports, owing to the reduced appropriations for Survey work by the 1915 Legislative Session, resulting in curtailment of the chemical staff and only a limited number of samples collected for analysis.

Special acknowledgment is here made for the hearty manner in which many oil and gas companies and individuals cooperated in furnishing valuable well records, sunk at private expense, and likewise important data obtained from engineers, managers and superintendents of coal mining operations, including logs of diamond drill core test borings sunk to test the coal beds. Due credit for all such material received is given in the text.

Finally, as in previous Reports, the author takes pleasure in acknowledging the receipt of valuable suggestions and aid from Dr. I. C. White, State Geologist.

RAY V. HENNEN.

Morgantown, W. Va., March 8, 1917.

ERRATA.

Page 54, 3rd line from top, for "sandsone" read "Sandstone."

Page 86, 22nd line from bottom, for "Distruct" read "District."

Page 319, top line, for "No. 69" read "No. 69A."

Page 321, 19th line from top, for "Chapter III" read "Chapter IV."

Page 595, omit last line, "169—Geology."

PART I.

History and Physiography.

CHAPTER I.

HISTORICAL AND INDUSTRIAL DEVELOPMENT.

LOCATION.

Braxton and Clay Counties, comprising the area described in this Report, are situated in the geographical center of the State of West Virginia, and are included between the parallels of 38° 55′ and 38° 15′ North Latitude, and 80° 26′ and 81° 17½′ meridians of West Longitude from Greenwich, England. **Braxton County** is bounded on the north by Gilmer and Lewis; on the east by Lewis and Webster; on the south by Webster, Nicholas, and Clay; and on the west by Clay, Calhoun, and Lewis Counties. **Clay County** is bounded on the north by Kanawha, Roane, Calhoun, and Braxton; on the east by Braxton and Nicholas; on the south by Nicholas and Kanawha; and on the west by Kanawha, Roane, and Calhoun Counties. Their geographic position may be observed at a glance on Figure 2 in the Author's Preface. The total area of both, as shown on subsequent pages by magisterial districts, is 866.31 square miles.

TRANSPORTATION.

Water Ways.

Little Kanawha River. — The Little Kanawha River, which flows in a northwest direction entirely across Braxton County, was formerly an important artery of commerce, in that during its flood stages of the spring and winter months it served to transport timber in log form to the large mills near its mouth at Parkersburg. This prominence has been largely lost since the completion of the Richwood Branch of the Baltimore and Ohio Railroad in 1890-1. On pages 2 and 3 of the Lewis and Gilmer County Report, D. B. Reger gives an interesting account of the attempts to extend the lock and dam system on this stream between Parkersburg and Burning Springs farther up the river, as also the last report of the U. S. War Department on the practicability of the scheme, the latter virtually condemning the project.

Elk River.—The Elk River, flowing in a southwest direction entirely across both counties, also was formerly an invaluable means of transporting large rafts of logs and crossties to its mouth at Charleston, as well as large freight canoes. Like the Little Kanawha River, it lost its importance in this respect on the completion of the Richwood Branch of the Baltimore and Ohio and the Coal and Coke Railways. Since there is no lock and dam system along any portion of its course, transportation is confined mostly to its flood stages during the spring and winter months.

Steam Railroads.

Richwood Branch—Baltimore and Ohio Railroad.—The Richwood Branch of the Baltimore and Ohio Railroad, extending in a general north and south direction entirely across Braxton County from Clarksburg in Harrison County to Richwood in Nicholas County for a distance of 121 miles, was chartered and built as a narrow gauge by Hon. J. N. Camden and others under the name of the Clarksburg, Weston and

Glenville Transportation Company. Concerning it, D. B. Reger[1] gives the following account:

> "That portion of the line between Weston and Clarksburg, according to Capt. Thomas Smith, a veteran conductor of the road, was completed in July, 1879, and to Buckhannon in June, 1883. In 1891 and 1892, the West Virginia and Pittsburgh Railroad Company took possession of the line and changed it to standard gauge. The same company extended the road as a standard gauge from Weston to Flatwoods in 1890 and 1891, and to Camden-on-Gauley in 1891 and 1892, and finally completed it from Flatwoods to Richwood in 1899. The road was sold to the Baltimore and Ohio Railroad in September, 1899."

The road was first completed from Weston through to Sutton and then followed the spur from Flatwoods to Richwood. Each terminated in a region previously unopened and started the manufacture of lumber on a large scale from the adjoining forests.

Coal and Coke Railway.—The Coal and Coke Railway, which extends in a general northeast-southwest direction from Elkins to Charleston, a distance of 175 miles, traverses entirely across both counties as shown on both Maps I and II. This road was first built from Charleston to Clendenin along the south bank of the Elk River in 1890, under the name of the Charleston, Clendenin and Sutton Railroad. According to H. B. Davenport, of Clay, it was extended to Clay Court-House in December, 1895, and the first passenger-train run between the latter point and Charleston on December 10, 1895. The terminus remained at Clay Court-House until 1900 when the line was extended to Ivydale, 12 miles above. In 1903 it was purchased by Hon. Henry G. Davis and his associates and organized under its present name and completed through to Elkins in 1906.

Buffalo Creek and Gauley Railroad.—The Buffalo Creek and Gauley Railway, which connects with the Coal and Coke Railroad at Dundon, was completed in 1910 and extends up Buffalo Creek to Widen, the largest town in Clay County and the location of the largest coal mining plant in the territory of this Report. Its total length is 18 miles, all of which is within the latter county.

Elk and Little Kanawha Railroad.—The Elk and Little

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[1] Lewis-Gilmer Report, W. Va. Geol. Survey, pp. 3-4; 1916.

Kanawha Railroad, which extends from Gassaway to Stumptown in Gilmer County for a distance of 36 miles, is of narrow-gauge construction and carries both passengers and commercial freight between Gassaway and Shock Station on Right Fork of Steer Creek. From the latter point to its terminus at Stumptown, it is operated only as a private lumber railway. It was completed in 1913 and furnishes a large amount of freight for the Coal and Coke Railroad.

West Virginia Midland Railroad.—This railway extends between Holly Junction and Webster Springs. The following communication from Geo. A. Hechmer, General Manager, to the writer, dated February 24, 1916, gives interesting data concerning it:

"'In reply to your letter of the 21st instant, I beg to state that the West Virginia Midland Railroad Company was incorporated in 1905, for the purpose of building a railroad from Sutton in Braxton County to Marlinton in Pocahontas County. In April, 1906, this company purchased and took over the Holly River and Addison Railway Company, which operated a road from Holly Junction to Webster Springs, West Virginia, and which company had purchased the Holly River Railroad Company property, and built the line from Holly in Braxton County to Hechmer on Holly River in Webster County. This company built the line from Diana, a point on its main line, to Webster Springs, with a view of developing and offering rail facilities for the visitors there in the summer months for the purpose of drinking the Salt Sulphur Waters, then and now so justly famous and well known.

"This company owes its existence to the untiring efforts of Hon. John T. McGraw, of Grafton, W. Va., who has been the prime mover and person responsible for the development of this road.

"The mileage of this company in Braxton County is 12.16 miles, and total mileage, 45 miles.

"The line from Holly to Hechmer was built in 1899,
Holly to Webster Springs, 1901 and 1902,
Webster Springs to Breece, 1906,
Holly to Long Run, 1910,
Marpleton to Coal Bank, 1911,

"There has been in addition to the above work some grading done along the main line for the purpose of standardizing the road, and some from Skelt on the Back Fork of Elk River, to connect the Pickens and Webster Springs Railroad with the West Virginia Midland R. R., with a view of opening a through line from Holly Junction to Pickens, in Randolph County.

"We have now under way plans for the complete standardizing of the road from Holly Junction to the mouth of Leatherwood Creek in Webster County, on the main Elk River, the proposed line to follow the waters of Holly River to the mouth of Grassy Creek, up Grassy Creek to the divide with Elk, through the hill by a tunnel 1150 feet long, and thence to Webster Springs on a very low grade against outbound traffic.

"I do not have the elevations at hand but as I recall some of them from memory, which you can perhaps verify: Holly Junction, 916 feet; Palmer, 921 feet; Diana, 1346 feet; Summit, 2128 feet; Webster Springs, 1460 feet."

Highways.

In the territory of this Report, the public highways consist of unimproved dirt roads and bridle paths or trails. No macadamized turnpikes have ever been built. In the southeastern half of the county, the existing wagon roads are generally narrow, rough and poorly graded, often following the bed of the larger streams, thus making it difficult and dangerous to travel over them in vehicles, especially during the spring and winter months. For this reason, along with the lack of highway bridges, the public schools begin several weeks earlier in the year than in more improved counties. In the northwest half of the area, the outcropping red limy shales of the Monongahela and Conemaugh Series tend to make these dirt roads muddy and almost impassable during the spring and winter, especially where they are subjected to the heavy haulage incident to the development of oil and gas territory. In the southeastern half the prevailing sandy soil of the Allegheny and Pottsville Series tends to prevent muddy roads wherever any attempt is made to drain them. This feature in connection with the abundance of sandstone material always near at hand makes it possible to build good roads, adapted to light traffic, very cheaply. According to A. D. Williams, State Road Engineer, there are 780 miles of wagon roads in Braxton County, of which 80 miles are well drained, and 450. in Clay, or a total for the area of 1230 miles.

GENERAL DESCRIPTION, BRAXTON COUNTY.

Miscellaneous Items.

Formation.—The writer is indebted to John D. Sutton of Sutton, West Virginia, for the following account of the early settlement and formation of Braxton County:

"Braxton County, the central county of the State, was formed from Nicholas, Lewis and Kanawha in 1836, and was named in honor of Carter Braxton, one of the signers of the Declaration of Independence. Sutton, the county-seat, was named for John D. Sutton, who owned the land where the town now stands. He gave a plot containing one acre of land for the public buildings and grounds for the streets and alleys. The county at the time of its formation comprehended Elk River and most of its tributaries from Fork Lick in the present county of Webster; it also comprehended Little Kanawha River and most of its tributaries above the mouth of Buffalo Shoal Run. It contained about three thousand inhabitants and but few colored people. The first inhabitants that came to the territory that now embraces Braxton were the Carpenters. They were a bold and adventurous people. Four of the Carpenter brothers had been in the Revolutionary Army. They settled at the mouth of Holly River about the year 1789 or '90. Benjamin, the youngest brother, together with his wife, was murdered by the Indians in 1792, that being the last raid the Indians made in central West Virginia. Adam O'Brien. the famous Indian scout and hunter, helped to make the first survey of land that was located in the territory now embraced in Braxton. This survey was made in the summer of 1784, and was then in the county of Monongalia. They began at a poplar tree standing in the low gap at the head of Granny Creek on the bison range. This survey embraced 13 blocks of 1000 acres each patented in the name of John Allison of Philadelphia. This land embraced the territory upon which Sutton and Gassaway now stand and for several miles down Elk River There were but few permanent settlers in Braxton County until about the year 1805; then came the Murphys, the Mases, the Frames, the Givens, the Byrnes, the Haymonds, Mollohans, Suttons, Squires, Singletons, Skidmores, later the Hyers, Shavers, Morrisons, Bells, Berrys, and Heaters. The early emigrants to Braxton came principally from Pendleton, Randolph, and Greenbrier Counties.

"The first county court was held in a log house belonging to John D. Sutton. The county was organized in 1836. Edward L. Duncan was Judge of the District; Solomon Wyatt was the first Prosecuting Attorney; William P. Newlon, Clerk; and Felix Sutton, the first Surveyor."

Area.—The original area of Braxton was considerably reduced by including portions of it in Webster and Clay on the formation of the latter counties. Its present area, as determined with planimeter by D. D. Teets from the topographic sheets of the U. S. Geological Survey, is as follows, by magisterial districts:

District.	Square Miles.
Salt Lick	137.37
Otter	156.26
Birch	111.82
Holly	114.25
Total for Braxton County	519.70

Relief.—The surface of Braxton County ranges from 760 feet above sea-level, at the intersection of Elk River with the

Clay-Braxton Line, to about 2160 feet above the same datum at the summit of the high knob in the southeast edge of the county, ¾ mile west of Waggy. This gives a range between the two extremes of only 1400 feet, thus making the climatic conditions practically the same throughout its area.

Population.—The following table gives the population of Braxton by magisterial districts, as shown by the U. S. Census returns for the last three enumerations:

Population of Braxton County.

Districts.	1910	1900	1890
Salt Lick, including Burnsville town, part of Flatwoods town and what was formerly Kanawha District	6504	5768	5099
Otter, including Gassaway and part of Sutton towns	6955	4974	3662
Birch, including Frametown town	4322	3673	2717
Holly, including part of Flatwoods, and Sutton towns	5242	4489	2450
Totals for Braxton County	23023	18904	13928

The results show that the percentage of increase from 1890 to 1900 is 42.9, and from 1900 to 1910 is 17.9. For comparative purposes, it is worthy of mention that that for the State for the years ending in 1910 was 27.4 per cent., and for the entire United States, 21 per cent. The density of population for Braxton in 1910 was 44.3 persons to the square mile; that, for the State in the same year, 49.9; and that for the continental United States, 30.4. Since there are no towns in the county that attain 2500 or more inhabitants, the entire population should be classed as rural.

Products.—The principal animal products are horses, mules, cattle, sheep, wool, hogs, poultry, eggs, and butter.

The principal vegetable products are lumber, corn, wheat, oats, hay, potatoes, garden vegetables, peaches, and apples.

The principal mineral products are petroleum, natural gas, and bituminous coal. Their development and occurrence will be further described in Chapters IX and X. Lumber is the most important manufactured product. Sandstone of fair quality for building purposes and crushing into concrete aggregate is found in abundance, as also shale for the manufacture of building and paving brick. These will also be further described in Chapter XI.

Property Valuation.—The State Auditor gives the following property valuations for Braxton County for the years 1914 and 1915:

	1914.	1915.
Real Estate	$ 7,984,465	$ 8,010,500
Personal Property	2,974,574	2,980,520
Totals	$10,959,039	$10,991,020

Postal Service.—The establishment of rural free delivery has caused the abandonment of many of the small post-offices scattered over the County. The following table, compiled from information supplied by M. T. Morrison, Postmaster at Sutton, shows the post-offices now in existence in Braxton:

Braxton County Post-Offices.

Belfont
Bender
Bower
Braxton
Brush
Burnsville
Chapel
Clem
Copen
Cutlips
Davison
Dessie
Dingy
Elmira
Exchange
Frametown
Gassaway
Gip
Glendon
Hettie
Jennings
Joppa
Knapp
Knawl
Little Otter
Progress
Riffle
Rosedale
Servia
Sleith
Strange Creek
Sutton
Tague'
Wade
Waldeck
Wildcat
Wire Bridge

According to Mr. Morrison, there are only two rural free delivery routes in the county; one having its origin at Sutton, known as Sutton R. F. D. No. 1, and the other at Frametown, known as Frametown R. F. D. No. 1.

Towns and Industries.

Sutton, the County-Seat of Braxton, is situated near the geographical center of the County and State, along both banks of Elk River, and is connected by branch railways with both the Baltimore and Ohio and the Coal and Coke Railroads. As mentioned on a preceding page, it was named from John D Sutton who owned the land where the town is located. Concerning it, Lewis[2] gives the following account:

> "Sutton, the County-Seat, was established a town by the name of Suttonville—then in Nicholas County—by act of Assembly, January 27, 1826. By act of March 1, 1837, it then being in the new County of Braxton, the name was changed to Sutton, and Benjamin Boggs, William Newland, Andrew Sterrett, and Alonzo D. Camden were appointed trustees. The town was incorporated February 20, 1860, when John G. Heffner, James M. Corley, C. W. Kelly, and A. C. Kincaid were appointed to conduct the first municipal election."

Before 1836, according to J. M. Callahan[3], it had scarcely a dozen inhabitants and was known by its post-office name, Newville. The U. S. Census for the three decades ending with 1910 gives the population as follows: 1121 for 1910; 864 for 1900; and 276 for 1890. The rapid growth shown between 1890 and 1900 was due to the completion in this period of the present branch of the Baltimore and Ohio Railroad to this point, which resulted in the establishment of a large lumber mill here.

Gassaway. — Gassaway is located on Elk River at the mouth of Little Otter Creek and was named for Hon. Henry Gassaway Davis, a former United States Senator and once candidate for Vice-President of the United States. It is now the largest town in Braxton County, its population being estimated at 1600 persons. It was incorporated as the Town of Gassaway in 1905, during the construction of the Coal and Coke Railway, to the location of whose shops at this point the town owes its rapid growth. It is also the terminus of the Elk and Little Kanawha Railroad, described on a previous page of this Report, and is connected with Sutton by a spur off the Coal and Coke. The U. S. Census returns for 1910 give its population as 1086.

Burnsville.—Burnsville, the third largest incorporated town in Braxton County, is located on the Little Kanawha River at the mouths of Oil and Saltlick Creeks. It was incorporated as the Town of Burnsville in 1902, and its population, according to the U. S. Census returns for 1910, was 770 persons. Both the Baltimore and Ohio and the Coal and Coke Railroads pass through it. The lumber industry and the development of the natural gas fields in the surrounding region have both contributed to its growth. It is surrounded by a fairly rich agricultural region.

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[2] V. A. Lewis, History of West Virginia, p. 674; 1889.

[3] Semi-Centennial History of W. Va., p. 63; 1913.

Flatwoods.—Flatwoods is located on the head of Right Fork of O'Brien Creek along the main line of the Richwood Branch of the Baltimore and Ohio Railroad. It is also connected with Sutton by a spur—6 miles in length—off the same road. It was incorporated as Flat Woods town in 1898, according to the Postmaster. The U. S. Census returns for 1910 give its population as 329, which ranks it fourth among the incorporated towns of the County. In 1915 its population was only 275, according to A. M. Berry, Postmaster.

Frametown.—Frametown, in Braxton County, is located along both banks of Elk River on the Coal and Coke Railway. It was incorporated as Frametown in 1901. The U. S. Census of 1910 gives its population as 163 persons.

Villages.—There are a number of unincorporated villages scattered over Braxton County, which space will not permit to describe in this Report. The following table gives a list of these along with their respective populations, small settlements containing only a few persons not being shown:

Population of Unincorporated Villages in Braxton County.

Villages.	Population.	Villages.	Population.
Bower	250(E)	Newville	77(C)
Centralia	235(E)	Orlando	250(E)
Copen	225(E)	Palmer	91(R)
Gem (Coger)	106(C)	Servia	110(R) 60(C)
Heaters	100(E)	Strange Creek	45(C)

(C) Actual count by postmaster or other reliable person.
(E) Estimate by postmaster or other reliable person.
(R) Rand, McNally & Co. Shippers' Guide to W. Va., population for 1910.

GENERAL DESCRIPTION, CLAY COUNTY.

Miscellaneous Items.

Formation.—According to V. A. Lewis[4], Clay County was formed from parts of Braxton and Nicholas by an act of March 29, 1858, and named in honor of Kentucky's favorite son—Henry Clay,—the seat of justice to be on the McCalgin farm, opposite the mouth of Buffalo Creek, and to be known by the name of Marshall. The first Circuit Court convened October 21, 1858, with Judge E. B. Bailey presiding. The first County Court was held July 12th, 1858. An act of the Legislature passed March 10, 1863, changed the name of the County-Seat from Marshall to Henry.

According to H. B. Davenport of Clay, the first settler of the county was Sinnett Triplett, who located on Buffalo Creek at the mouth of Lilly Fork, about 1830 to 1840, and the next was an Irishman by the name of McCalgin who located at the present site of Henry. The early settlers were a hunting class of people that largely drifted into Clay County from Nicholas.

Area.—The area of Clay County, as determined by D. D. Teets with planimeter from the accurate topographic sheets of the U. S. Geological Survey, is as follows by magisterial districts:

Districts.	Square Miles.
Otter	49.51
Buffalo	67.68
Henry	114.78
Pleasant	63.12
Union	51.52
Total for Clay County	346.61

The boundary line between Clay and Nicholas has long been in dispute. Its location on Maps I and II is as determined by a compromise agreement between the two counties during 1915, the above areal results having been made with the line location revised. Mr. R. M. Cavendish of Sutton, West Virginia, has kindly furnished the Survey the following description of this compromise line:

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[4] History of W. Va., pp. 724-5; 1889.

> "Beginning at the corner of Clay, Braxton, and Nicholas, there is no change as shown on the sheets[3] until you get to the corner on Strange Creek at the mouth of Road Fork. The bearings and distances from that point are S. 53° 45′ W. 7.88 miles, crossing Buffalo Creek and the several branches, to a stone on the east side of Hickory Fork of Dog Run; thence S. 61° 15′ W. 14.34 miles, crossing various branches of Elk River and Twentymile Creek, to a stone on the west bank of Road Fork of Rockcamp Fork of Twentymile Creek; thence S. 65° 25′ W. 4.75 miles, crossing Bell Creek at Scotford, to a large white oak on Rockcamp Fork of Bell Creek; and thence S. 34° W. 1375 feet to a white-oak stump at the forks of Rockcamp Fork and Bell Creek. The line passes 110 feet south of the 'B. M.' on Road Fork of Leatherwood."

Relief.—The surface of Clay County varies from 605 feet above sea-level in the bed of Elk River at Queen Shoals to about 1875 feet above the same datum on the summit of the high knob 2 miles northeast of Widen and 1.5 miles southwest of Dille, in the eastern edge of the county—a range in elevation between the two extremes of 1270 feet. There are no prominent mountain ranges traversing the area, the differences of elevation being due to a gradual rise to the southeastward of both the valley floors and hill summits. The reader is referred to Map I for an accurate topographic map of both counties, with a 50-foot contour interval.

Population.—The population of Clay County is given in the following table by magisterial districts, as taken from the U. S. Census returns for the last three enumerations:

Population of Clay County.

Districts.	1910	1900	1890
Otter	1863	1194	851
Buffalo, including Ivydale town	1904	1034	906
Henry, including Henry town (Clay)	3034	2781	1091
Pleasant	1938	1750	986
Union	1494	1489	825
Totals for Clay County	10233	8248	4659

These figures show that the growth in population in Clay County has been fairly rapid, the gain in per cent. being 77 from 1890 to 1900; and 24 from 1900 to 1910. The density of population in the latter year was 29.5 persons to the square mile, or considerably less than shown for Braxton County on a preceding page. Its population may be classed as rural for the same reason as mentioned for the latter area.

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[3] U. S. Geol. Survey topographic sheets, scale of 1 to 62,500.

Products.—The principal products of Clay County—animal, vegetable, and mineral—are practically the same as given for Braxton on a preceding page. A marked interest in scientific agriculture has been awakened within the last three or four years, especially in the latter County where about 40 silos were constructed during 1915 and an expert agricultural agent employed.

Property Valuations.—The State Auditor gives the following property valuations for Clay County for the years 1914 and 1915:

	1914.	1915.
Real Estate	$3,183,021	$3,182,554
Personal Property	1,120,310	1,058,816
Totals for Clay County	$4,303,331	$4,241,370

The following table, compiled from data furnished by Mr. Buren Stephenson, Postmaster at Clay, shows the post-offices now in existence in the County:

Clay County Post-Offices.

Bentree
Big Otter
Birch Run
Bomont
Clay
Cressmont
Crosby
Dille
Dink
Dundon
Duck
Eakle
Elda
Eldorado
Elkhurst
Enoch
Fola
Glen
Harrison
Indore
Ira
Ivydale
Lizemores
Mamie
Maysel
Nebo
Odessa
Osie
Paxton
Procious
Queen Shoals
Serena
Valleyfork
Wallback
Warfield
Widen

Towns and Industries.

Henry (Clay P. O.), the County-Seat of Clay County, is situated mostly on the north bank of Elk River at the mouth of Buffalo Creek, along the main line of the Coal and Coke Railway. As mentioned under the description of the formation of Clay County on a preceding page, the first settler at this point was a man by the name of McCalgin. It was first named Marshall after Chief Justice Marshall of the Supreme

Court of the United States, and changed in 1863 to Henry. According to H. B. Davenport, it was incorporated as the Town of Henry by the Circuit Court of Clay County in 1895, which name is its official designation at present, although its post-office name is Clay and that for the Coal and Coke Railway Station and express office is Clay Court-House. Its post-office designation predominates, the official name Henry rarely ever being mentioned by the natives. The first passenger-train over the Charleston, Clendenin and Sutton Railway (now Coal and Coke) was run between Charleston and Clay Court-House on December 10, 1895, according to Mr. Davenport, who estimates its population at about 600 persons at present. The U. S. Census returns for the years 1910 and 1900 give it 392 and 339, respectively.

Ivydale.—Ivydale, incorporated as a town in 1902, is located along both banks of Elk River at the mouth of Otter Creek on the main line of the Coal and Coke Railway. It is also known by the name of Otter. The U. S. Census returns for 1910 give its population as 236 persons.

Villages.—As in Braxton, there are a number of unincorporated villages scattered over Clay County. Among these the mining town of Widen, 18 miles from Clay on Buffalo Creek at the terminus of the Buffalo Creek and Gauley Railroad, established in 1910, has a population of about 1200 persons, making it the largest settlement in the county. The following table gives a list of the unincorporated villages along with their respective populations, small settlements containing only a few persons not being shown:

Population of Unincorporated Villages in Clay County.

Villages.	Population.	Villages	Population.
Dorfee	87(R)	Odessa	200(E)
Eldorado	78(R)	Queen Shoals	125(R) 7(C)
Elkhurst	92(R)	Scotford	52(R)
Ira (Groves)	100(C)	Widen	1200
Procious	150(R) 172(C)		

(C) Actual count by postmaster or other reliable person.
(E) Estimate by postmaster or other reliable person.
(R) Rand, McNally & Co. Shippers' Guide to W. Va., population for 1910.

CHAPTER II.

PHYSIOGRAPHY.

PHYSIOGRAPHIC CHANGES.

Since Braxton and Clay lie in the central portion of the State on the eastern slope of the great Appalachian geosyncline, their surface features present little change from that described in previous Reports of the State Geological Survey for the central belt of Counties, in that the hill and ridge summits, forming the sky-line, represent the remains of an old peneplain that was formed during Cretaceous time and almost reached base-level, the drainage then as now having a general northwest direction. This was followed by an uplift along the axis of the Appalachian system to the southeast of the area in question, which elevated the entire surface of the peneplain and tilted it at a small angle to the northwest. The erosive action of the streams was greatly quickened during the period of quiescence of the subterranean forces which followed. That this tilting actually happened is evidenced by the gradual southeastward rise of the hill and ridge summits from the western margins of both counties. Along the west boundaries of Braxton and Clay, these range from 1400 to 1500 feet above sea-level, while on the east, they vary from 1900 to 2100 feet above the same datum. The land forms now present a highly dissected plateau as a result of the stream erosion that followed and little remains of the original smooth surface of the peneplain. There is abundant evidence that many of the larger streams of each county reached base-level during the formation of this Cretaceous peneplain. Both the Little Kanawha and Elk Rivers and their larger tributaries flow in deeply indented valleys, although possessing widely meandering courses. The latter feature is evidently an inheritance from Cretaceous time, since it would be difficult to explain these sinuous channels on any other ground than that of a previous base-leveled condition. The streams have not advanced very far in their present erosive cycle as is evidenced by their narrow, deeply carved and V-shaped valleys, although longitudinally approaching maturity, since they have a comparatively low gradient almost to their headwaters.

The following table, prepared by D. D. Teets from careful determinations on the U. S. Geological Survey sheets, gives much data of interest on the streams in the two counties. The last column shows the ratio of the total distance (T. D.) to the air-line distance (A. L. D.), indicating the amount the stream has deviated from a straight line in that portion of its course designated in the first column. It follows that the nearer this ratio approaches unity, the straighter its course becomes:

Table of Stream Data.

Streams.	Total Fall. Feet.	Total Distance. Miles.	Rate of Fall per mile. Feet.	Air-Line Distance Miles.	Ratio of T. D to A. L. D.
Little Kanawha River, Wildcat to Falls Mill	145	11.5	26.1	5.8	2.0
Falls Mill to mouth of Copen	65	17.2	3.8	11.7	1.5
Oil Creek, Peterson to Burnsville	100	7.9	12.7	6.7	1.2
Saltlick Creek, Corley to O'Brien Creek	60	4.9	12.2	4.1	1.2
O'Brien Creek to Burnsville	45	7.5	6.0	5.0	1.5
Cedar Creek, Riffle to Cutlips	75	3.6	20.8	3.1	1.2
Cutlips to Braxton-Gilmer Line	50	4.9	10.2	3.3	1.5
Right Fork Steer Creek, Dessie to Tague Fork	105	4.0	26.3	3.3	1.2
Tague Fork to Rosedale	50	3.5	14.3	3.1	1.1
Elk River, Braxton-Webster Line to Palmer	55	5.0	11.0	3.7	1.4
Palmer to Sutton	65	11.3	5.8	6.6	1.7
Sutton to Glendon	45	18.9	2.4	10.7	1.8
Glendon to Ivydale	40	15.0	2.7	9.2	1.6
Ivydale to Clay	50	12.4	4.0	6.0	2.1
Clay to Big Sycamore	30	9.4	3.2	5.3	1.8
Big Sycamore to Queen Shoals	45	16.4	2.7	6.7	2.4
Holly River and Right Fork:					
Diana to Fishers Crossing	175	6.4	27.3	5.3	1.2
Fishers Crossing to Palmer	170	9.5	17.8	6.3	1.5
Laurel Creek, Erbacon to Centralia	585	8.0	73.1	6.9	1.2
Wolf Creek, Spruce Fork to mouth	255	4.2	60.4	3.3	1.3
Birch River, Nicholas-Braxton Line to Glendon	210	12.6	16.7	5.9	2.1

Streams.	Total Fall. Feet.	Total Distance. Miles.	Rate of Fall per mile. Feet.	Air-Line Distance. Miles.	Ratio of T. D. to A. L. D.
Little Birch River, Right Fork to Little Birch P. O.	175	4.4	39.8	3.4	1.3
Little Birch P. O., to mouth	125	6.4	19.5	4.7	1.4
Strange Creek, Dille to Jennings	315	6.8	46.3	4.7	1.4
Jennings to Strange Creek Station	130	4.0	32.5	2.4	1.7
Otter Creek, Big Otter P. O. to Ivydale	130	7.8	16.7	4.8	1.6
Laurel Creek, Valley Fork P. O. to Horner Fork	145	3.7	39.7	3.2	1.2
Horner Fork to Rouzer	120	5.0	24.0	2.3	2.2
Buffalo Creek, Widen to Cressmont	290	8.9	32.6	6.3	1.4
Cressmont to Dundon	135	7.9	17.1	5.1	1.6
Lilly Fork, Nicholas-Clay Line to Campbell Branch	310	5.7	54.4	4.6	1.2
Campbell Branch to Avoca	140	3.2	43.7	2.8	1.1
Leatherwood Creek, Nicholas-Clay Line to Right Fork	285	4.7	60.6	4.1	1.1
Right Fork to Elk River	80	4.0	20.0	3.4	1.2
Middle Creek, Rosetta School to Elk River	440	6.1	72.1	5.3	1.2
Sycamore Creek, Nicholas-Clay Line to Adonijah Branch	415	5.8	71.5	5.0	1.2
Adonijah Branch to Eldorado	150	5.3	28.3	3.9	1.4
Porter Creek, Glen to Bomont	190	4.3	44.2	3.9	1.1
Bomont to Porter	210	3.3	63.6	2.7	1.2

The sinuous courses of the above-listed streams have been inherited from their ancient base-leveled channels of the Cretaceous peneplain described on preceding pages of this Chapter, rather than due to any interruption in comparatively recent time to the direction of flow by intersection with prominent structural features. The formation of the anticlines and synclines took place so gradually that the streams crossing them were able to cut down their beds and still preserve their general northwest direction intact.

DRAINAGE BASINS.

The entire drainage of Braxton and Clay reaches the Gulf of Mexico through the Ohio and Mississippi Rivers, the water being carried to the former by the Little Kanawha River and by the Elk and Gauley, tributaries of the Great Kanawha, the

Little Kanawha emptying into the Ohio at Parkersburg and the latter, at Point Pleasant.

The following table gives the area of the drainage basins of the principal streams of the two counties as determined by Teets with planimeter from the accurate topographic sheets of the U. S. Geological Survey:

Area of Drainage Basins.

Streams.	Square Miles.
Little Kanawha River, entire basin above Parkersburg	2150.00
Little Kanawha River, above Gilmer-Braxton Line..	250.00
Oil Creek	31.90
Knawl Creek	16.70
Saltlick Creek	48.60
Copen Run	9.70
Cedar Creek, above Braxton-Gilmer Line	39.80
Right Fork of Steer Creek, above Rosedale	38.35
Left Fork of Steer Creek above Braxton-Gilmer Line	17.10
Elk River, entire basin above Charleston	1550.00
Elk River, entire basin above Queen Shoals	1165.00
Elk River, entire area above Palmer including Holly River	500.00
Holly River, including portion in Webster and Randolph	150.00
Wolf Creek	12.90
Little Otter Creek	12.60
Birch River, including portion in Nicholas and Webster Counties	140.60
Little Birch River, including portion in Webster County	40.00
Strange Creek, including portion in Nicholas County	27.45
Buffalo Creek, including portion in Nicholas County	113.30
Lilly Fork, including portion in Nicholas County.	28.75
Leatherwood Creek, including portion in Nicholas County	23.00
Middle Creek	9.45
Sycamore Creek, including portion in Nicholas County	30.90
Porter Creek	10.65
Laurel Creek	19.40
Otter Creek	26.95

The Little Kanawha River.

The Little Kanawha River heads near Craddock in Upshur County at an elevation of 2765 feet above sea-level, and flows in a general northwest direction nearly at right angles to adjacent minor folds of the Appalachian Mountain System, through Upshur, Lewis, Braxton, Gilmer, Calhoun, Wirt, and Wood Counties into the Ohio at Parkersburg, where it has dropped to 564 feet above sea-level—a total fall of about 2200 feet. At the Braxton-Lewis County Line, its elevation is 950 feet and at the Braxton-Gilmer Line, 730 feet above the same datum. The total area of its drainage basin is about 2150 square miles, of which only 250 square miles is above its intersection with the Gilmer-Braxton County Line. With the exception of its headwaters in Lewis and Upshur, which are mostly forested, it flows through a cultivated region. This makes the run-off take place more rapidly and subjects its course to sudden floods during the winter and spring months. Its flood-plain ranges from 25 to 30 feet above low water.

Its principal tributaries in Braxton County are Oil, Knawl, Falls, Saltlick, Copen, Cedar, and Steer Creeks.

Abandoned Channel.—At Falls Mill, Braxton County, there is a recently abandoned channel of the Little Kanawha, its drainage having cut through the narrow neck of the peninsula included in an old loop of the river to the north. This old channel is now mostly occupied by Falls Creek in the last three-fourths mile of its course.

The Elk River.

The Elk River heads against the summit of Spruce Knob in Pocahontas County, 7½ miles northwest of Marlinton, at elevation of 4730 feet above sea-level, and flows northwestward through Pocahontas and Webster Counties to the territory of this Report. Here it takes a general southwest course through Braxton, Clay, and Kanawha Counties to its mouth at Charleston, where it has dropped to about 550 feet above sea-level—a total fall of 4180 feet. At its intersection with the

Webster-Braxton Line, its elevation is 945 feet and at Queen Shoals, 605 feet above the same datum. The total area of its drainage basin above the latter place is 1165 square miles. Its valley walls as also those of its tributaries are steep and high, tending to cause its run-off to occur quickly. However, this is retarded greatly owing to the fact that a great portion of its drainage basin is heavily forested or cut-over territory and the sandy and porous nature of the soils of the Allegheny and Pottsville strata. This results in the absorption of a considerable portion of every rainfall by this sponge-like surface, thus tending not only to prevent many disastrous floods, but also to preserve the flow of the larger streams during periods of prolonged drought.

Its principal tributaries from the north side are Holly River in Braxton and Otter and Laurel Creeks in Clay; and from the south side, Laurel and Strange Creeks and Birch River in Braxton, and Buffalo, Leatherwood, Middle, Sycamore and Porter Creeks in Clay. In both counties there is a marked difference in the length of the tributaries from the north and those from the south, the latter being much longer, with the exception of Holly River.

Abandoned Channels.—Immediately north and northwest of Bakers Run Station on the Richwood Branch of the Baltimore and Ohio Railroad, there appears to be two old abandoned channels of Elk River, both of which lie west of its present channel. The railroad mentioned follows the lowest and most easterly and probably the most recent in abandonment. Their existence is no doubt due to the same causes as that assigned for the same feature on the Little Kanawha on a preceding page of this Chapter.

TOPOGRAPHIC FEATURES.

The topography of Braxton and Clay offers little that is unusual to that described in previous Reports of the Survey on adjoining counties, in that the surface features of each show a regular succession of high sharp ridges, separated by narrow, deeply indented and V-shaped valleys. Along the western border, these ridge and hill summits range from 500 to 700 feet above the valley floors of the largest streams, while on the southeast margins, 600 to 1000 feet above the same datum are the prevailing figures. In the southern portion of Clay, practically no attempt has been made to cultivate these sharp ridges. There are numerous divides several hundred feet below the adjoining ridge summits, as also many knobs extending 100 to 200 feet above the general ridge levels. The valley floors, though narrow, frequently are wide enough to furnish sites for the future mining villages when the coal is taken out.

There are some special topographic features within the area that warrant description. The wide valley floor immediately northwest of McNutt Station on Granny Creek, eroded by a branch of the latter stream, as shown on Map I, is located on strata dipping rapidly to the northwest, a direction opposite to that of the drainage, so that the hard ledge of Buffalo Sandstone outcropping at McNutt has so retarded channel-cutting that the upper course of this branch of Granny Creek has been locally base-leveled in the softer overlying beds. The same reason accounts for the wide bottoms on Otter Creek in Clay County, immediately above and below Big Otter P. O., the hard stratum here that checked channel-cutting being the Upper Freeport Sandstone.

In Braxton, the wide flat valley floor, extending for about a mile on the head and across the divide from Lower Flatwoods Run, 3½ miles northeast of Sutton, and the general appearance of the topography to the northward, tend to the suspicion that this might be an old abandoned channel of a former tributary of the Little Kanawha River, and that an act of stream piracy may have been performed by Elk River in the immediate region, the theory being advanced that the present drainage of Elk above the vicinity of Lower Flatwoods Run might have belonged to the above-suggested tributary of the Little Kanawha River. To strengthen this hypothesis is the fact that above this point, Elk flows in a general northwest direction which is in harmony with that for all the other tributaries of the Little Kanawha in Braxton and Lewis Counties. Below this locality, Elk flows in a general southwest direction. The idea is advanced that this tributary may possibly have reached the Little Kanawha roughly along the present valley of Saltlick Creek. The summit at the head of Lower Flatwoods Run is about 1280 feet above sea-level, so that, if an act of piracy was performed here, both streams were flowing at a much higher elevation than now. No gravel or rounded boulders were found at this high level along the valley walls of either Lower Flatwoods Run or Saltlick Creek, but the evidence seemed sufficient to warrant a discussion of it.

RIVER TERRACES.

Along the valley walls of both the Little Kanawha and Elk and their larger tributaries, terrace clay deposits were observed, but with one or two exceptions, no rounded boulders were seen. The following table gives a list of these along the former river that appear to be contemporaneous with those noted by Reger[1] at Stouts Mills, Gilmer County, on the same stream:

Locality.	Tidal elevation top. Feet.	Height of top above river bed. Feet.
Stouts Mills	830	125
Burnsville, west hillside	865	125
Bulltown, 1.4 miles northwest of, west hillside.	880	100
Wildcat, 1 mile west of, north bank	970	35

These deposits occur on pronounced benches in the hillside slope, which are evidences of a base-leveled condition of the Little Kanawha that may be contemporaneous with the third of the series of Ohio River terraces.[2]

On Elk, the town of Sutton is partly built on a pronounced terrace on the north side of the river, ranging from 1000 to 1025 feet above sea-level and about 200 feet above low water. The writer was unable to trace this terrace on down Elk to the Kanawha County Line, owing to the time required to work out the difficult stratigraphy and the lack of benches at this high elevation along the wooded and generally steep valley walls. The two following terraces on this river contained deposits of both clay and rounded boulders and correspond to a base-leveled condition of Elk belonging at a much later erosive cycle than that mentioned above for Sutton, since it is over 100 feet lower in elevation:

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[1] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, p. 32; 1916.

[2] I. C. White, Report Q, Second Geol. Survey of Pa., p. 10; and Ray V. Hennen, Marshall-Wetzel-Tyler Report, W. Va. Geol. Survey, pp 49-50.

Locality.	Tidal elevation top. Feet.	Height of top above river bed. Feet.
Gassaway, 1¼ miles southeast of, opposite mouth of Little Buffalo Creek	885	80
Strange Creek Station, opposite mouth of Strange Creek	860	90

This terrace is probably contemporaneous with that described above for the Little Kanawha River. No other remnants of it were definitely recognized along Elk, but clay deposits were observed on apparent terraces both at Frametown and Glendon at about 1025 feet above sea-level—145 to 150 feet above the river. These seem to belong too high to join up with that described above for Sutton.

PART II.

Geology.

CHAPTER III.

STRUCTURE.

The general principles of geologic structure which treats of the pitch or lay of the stratified rocks, the methods used in representing it and the definition of terms have been given in a previous Report by the writer[1], to which the reader is referred.

METHOD OF REPRESENTING STRUCTURE.

The absence of faults and intense folding, resulting in "overturns", makes the contour method the only one necessary to represent the pitch or lay of the strata in the area in question. As in Wyoming and McDowell Counties, it was found more feasible to base the contours on two "key-rocks", instead of one; viz, the **Pittsburgh** and **Upper Kittanning Coal beds**, since these are both widely persistent and definitely recognized. It was found advantageous to use the former seam in that portion of each county lying northwest of the Upper Kittanning 500-foot contour above sea-level. All that portion of the area southeast of this line was based on the latter bed. The elevation of these coals above sea-level, as also the area covered by each set of contours, is shown in detail on Map II which accompanies this Report in a separate atlas—the **green** lines for the Pittsburgh Coal, and the **red** for the Upper Kittanning. In each set the contour interval is 25 feet, which makes it possible to determine the approximate position of any formation at any point by a liberal use of the two tables of intervals given below. By far the greater number of observations in the field was made with the aneroid, the latter being checked frequently on known spirit-level elevations. In localities where one or both the coals were below drainage or could not be found in the hills, observations were taken on other known formations and the true position of the "key-rocks" determined by intervals.

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[1] Ray V. Hennen, Marshall-Wetzel-Tyler Report, W. Va. Geol. Survey, pp. 59-60; 1909.

The interval between known members of the rock column does not hold good over a very large portion of either county, due to the rapid thickening up of the measures both southeastward and southwestward; hence, instead of using constant intervals between the Pittsburgh Coal and other known formations, and likewise for the Upper Kittanning, in determining the final position of the contour lines on Map II, a series of intervals for different localities in the area had to be devised. The first of the two following tables gives the intervals in feet above and below the base of the Pittsburgh Coal to the other formations named at the points designated. The second table in a similar manner gives the same data for the Upper Kittanning bed. It is readily observed that the greatest variation occurs in the latter table, owing to rapid changes in the thickness of members of the Kanawha Group of the Pottsville Series, this being especially true south of Elk River:

Intervals in Feet Above and Below the Pittsburgh Coal.

Members in Descending Order.	Burnsville.	Knawl—2 Mi. S. E.	Bulltown.	Rollyson.	Flatwoods.	Sutton.	Gassaway.	Rosedale.	Strange Creek.	Big Otter.	Wallback.	Valley Fork.	Members in Descending Order.
Waynesburg Sandstone, base	375	375	....	....	....	....	....	380	....	....	....	....	Waynesburg Sandstone, base.
Uniontown Coal	275	275	....	....	....	....	....	240	....	....	....	....	Uniontown Coal.
Sewickley Sandstone, top	180	180	180	190	190	190	190	165	....	200	....	....	Sewickley Sandstone, top.
PITTSBURGH COAL	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**PITTSBURGH COAL.**
Lower Pittsburgh Sandstone, base	80	80	80	80	80	80	80	80	80	80	100	90	Lower Pittsburgh Sandstone, base.
Connellsville Sandstone, base	145	145	145	150	155	155	155	155	155	155	160	160	Connellsville Sandstone, base.
Little Clarksburg Coal	150	150	150	155	160	160	160	160	160	160	165	165	Little Clarksburg Coal.
Morgantown Sandstone, base	225	225	225	250	270	275	280	270	275	275	280	280	Morgantown Sandstone, base.
Elk Lick Coal	240	250	245	260	275	280	290	275	290	290	290	290	Elk Lick Coal.
Harlem Coal	315	325	320	340	350	360	360	350	360	360	360	360	Harlem Coal.
Bakerstown Coal	430	440	420	440	440	440	450	460	460	440	450	450	Bakerstown Coal.
Brush Creek Coal	500	510	500	510	505	505	515	530	530	520	520	520	Brush Creek Coal.
Mahoning Coal	550	560	555	560	560	555	555	580	580	575	580	585	Mahoning Coal.
Upper Freeport Coal	610	615	610	620	625	620	625	640	640	630	630	640	Upper Freeport Coal.
Upper Freeport Sandstone, top	620	620	615	625	630	625	630	645	645	635	635	645	Upper Freeport Sandstone, top.
Upper Kittanning Coal	740	750	725	720	730	750	765	765	800	760	780	790	Upper Kittanning Coal.
Lower Kittanning Coal	820	845	830	810	820	840	865	865	930	880	900	920	Lower Kittanning Coal.
Homewood Sandstone, top	880	850	840	820	830	850	870	875	935	890	910	925	Homewood Sandstone, top.
Pottsville Series, base	1659	1600	1600	1760	1865	2000	1960	1685	....	1990	1995	2185	Pottsville Series, base.
Big Injun Sand, top	1909	1990	2000	1944	2095	2130	2025	1905	....	2265	2265	2495	Big Injun Sand, top.

Intervals Above and Below Upper Kittanning Coal.

Members in Descending Order.	BRAXTON COUNTY.												Members in Descending Order.
	Knawl—2 Mi. S. E.	Bablin.	Falls Mill.	Gem (Cogers), 2 Mi. S. E.	Sutton.	Palmer.	Marpleton.	Centralia.	Little Birch P. O.	Herold.	Frametown and Diatter Run.	Strange Creek and Glendon.	
Sewickley Sandstone, top	930	930	905	910	940	940	940	940	....	980	975	975	Sewickley Sandstone, top.
Pittsburgh Coal	750	750	725	720	750	750	750	750	....	790	785	785	Pittsburgh Coal.
Lower Pittsburgh Sandstone, base	670	670	645	640	670	650	650	650	....	700	700	700	Lower Pittsburgh Sandstone, base.
Little Clarksburg Coal	600	600	575	565	590	585	585	585	....	630	675	625	Little Clarksburg Coal.
Morgantown Sandstone, base	525	525	500	470	475	475	475	475	....	515	510	510	Morgantown Sandstone, base.
Elk Lick Coal	500	500	480	460	470	470	470	470	....	510	505	505	Elk Lick Coal.
Harlem Coal	425	425	405	380	390	390	390	390	410	430	425	425	Harlem Coal.
Bakerstown Coal	310	310	305	280	310	310	310	310	330	340	335	335	Bakerstown Coal.
Brush Creek Coal	240	240	225	210	245	235	235	235	260	270	265	265	Brush Creek Coal.
Mahoning Coal	190	190	170	160	195	170	180	180	200	210	205	205	Mahoning Coal.
Upper Freeport Coal	135	135	115	100	130	115	115	130	150	165	160	160	Upper Freeport Coal.
Upped Freeport Sandstone, top	130	130	110	100	130	110	110	130	150	160	160	155	Upper Freeport Sandstone, top.
Lower Freeport Coal	70	70	70	70	60	60	60	60	70	70	70	70	Lower Freeport Coal.
Upper Kittanning Coal.	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**Upper Kittanning Coal.**
Upper East Lynn Sandstone, top	5	5	5	5	5	5	5	....	5	0	0	5	Upper East Lynn Sandstone, top
Middle Kittanning Coal	....	....	....	....	....	....	....	....	90	80	80	90	Middle Kittanning Coal.
East Lynn Sandstone, top	....	....	20	....	....	....	....	....	90	80	80	90	East Lynn Sandstone, top.
Lower Kittanning Coal	90	80	80	90	90	110	110	110	130	130	120	130	Lower Kittanning Coal.
Clarion Coal	....	....	....	....	90	110	....	....	170	....	....	....	Clarion Coal.
Homewood Sandstone, top	90	90	90	....	90	115	....	....	170	....	....	....	Homewood Sandstone, top.
Kanawha Black Flint	....	260	....	....	(220)	265	265	265	(245)	(245)	....	....	Kanawha Black Flint.
Stockton Coal	....	265	....	....	(225)	270	270	270	(250)	(250)	....	....	Stockton Coal.
Coalburg Coal	....	....	....	....	....	305	305	305	....	....	....	....	Coalburg Coal.
Winifrede Coal	....	....	....	....	....	350	350	355	....	....	....	....	Winifrede Coal.
Chilton Coal	....	....	....	....	....	370	370	370	....	....	....	....	Chilton Coal.
Holly (Williamson) Coal	....	....	....	....	....	410	410	410	....	....	....	....	Holly (Williamson) Coal.
Cedar Grove Coal	....	....	....	....	....	510	510	510	....	....	....	....	Cedar Grove Coal.
No. 2 Gas Coal	....	....	....	....	....	....	....	....	....	....	....	....	No. 2 Gas Coal.
Eagle Coal	....	....	....	....	....	....	620	630	....	....	....	....	Eagle Coal.
Pottsville Series, base	825	900	....	1040	1250	1250	1250	1215	....	....	....	....	Pottsville Series, base.
Big Injun Sand, top	1160	1470	....	1225	1380	1575	1575	1770	....	....	....	....	Big Injun Sand, top.

Intervals Above and Below Upper Kittanning Coal.

Members in Descending Order	CLAY COUNTY.															Members in Descending Order.
	Big Otter P. O.	Groves.	Ivydale.	Clay.	Widen.	Beech Fork of Lilly.	Road Fork of Leatherwood.	Cottrill Fork, Middle Creek.	Dorfee.	Maysel.	Marne.	Queen Shoals.	Lick Branch of Adonijah.	Greendale and Scotford.	Cannel Coal Hollow, Mouth.	
Sewickley Sandstone, top	960	.....	990	1000	....	.....	....	.....	.....	....	....	....	....	....	....	Sewickley Sandstone, top.
Pittsburgh Coal	760	.....	800	805	....	.....	....	.....	.....	790	....	....	....	....	....	Pittsburgh Coal.
Lower Pittsburgh Sandstone, base	680	.....	710	715	....	.....	....	.....	.....	700	....	....	....	....	....	Lower Pittsburgh Sandstone, base.
Little Clarksburg Coal	600	.....	640	645	....	.....	....	.....	.....	595	....	....	....	....	....	Little Clarksburg Coal.
Morgantown Sandstone, base	485	.....	525	530	....	.....	....	.....	.....	510	....	....	....	....	....	Morgantown Sandstone, base.
Elk Lick Coal	470	.....	515	520	...	.....	....	.....	.....	500	....	....	....	....	....	Elk Lick Coal.
Harlem Coal	400	430	430	435	445	.....	....	.....	.....	430	....	435	....	....	....	Harlem Coal.
Bakerstown Coal	320	350	350	355	365	365	....	.....	355	350	....	355	355	....	355	Bakerstown Coal.
Brush Creek Coal	240	280	280	285	295	295	300	285	285	280	295	285	285	285	285	Brush Creek Coal.
Mahoning Coal	185	225	225	230	240	240	240	225	230	215	230	230	230	230	230	Mahoning Coal.
Upper Freeport Coal	130	170	170	175	185	185	185	170	175	160	175	175	175	175	175	Upper Freeport Coal.
Upper Freeport Sandstone, top	130	165	165	170	180	180	180	170	170	160	170	170	170	170	170	Upper Freeport Sandstone, top.
Lower Freeport Coal	60	75	80	80	80	80	80	80	80	70	80	80	80	80	80	Lower Freeport Coal.
Upper Kittanning Coal	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**Upper Kittanning Coal.**
Upper East Lynn Sandstone, top	0	0	15	0	5	5	5	0	0	0	0	0	5	5	5	Upper East Lynn Sandstone, top.
Middle Kittanning Coal	70	85	....	100	80	100	120	110	100	....	....	40	120	100	110	Middle Kittanning Coal.
East Lynn Sandstone, top	70	85	90	105	80	100	125	110	100	....	....	40	120	100	110	East Lynn Sandstone, top.
Lower Kittanning Coal	120	165	130	145	150	175	190	190	175	150	140	140	160	160	190	Lower Kittanning Coal.
Clarion Coal	....	.....	....	....	180	200	210	.....	(200)	150	....	....	....	180	210	Clarion Coal.
Homewood Sandstone, top	130	220	170	145	180	200	210	.....	(200)	150	....	140	....	180	210	Homewood Sandstone, top.
Kanawha Black Flint	....	(275)	265	285	270	280	300	275	290	....	250	205	300	285	290	Kanawha Black Flint.
Stockton Coal	....	(280)	270	290	275	285	305	280	295	....	255	210	305	290	295	Stockton Coal.
Coalburg Coal	....	.....	....	335	330	(340)	350	310	305	....	280	245	330	380	315	Coalburg Coal.
Winifrede Coal	....	.....	....	405	400	(400)	420	390	390	....	....	....	405	455	390	Winifrede Coal.
Chilton Coal	....	.....	....	450	450	475	540	(500)	450	....	....	....	480	500	455	Chilton Coal.
Holly (Williamson) Coal	....	.....	....	500	....	525	....	.....	.....	....	....	....	530	560	515	Holly (Williamson) Coal.
Cedar Grove Coal	....	.....	....	600	....	580	....	.....	(670)	....	....	....	600	610	....	Cedar Grove Coal.
No. 2 Gas Coal	....	.....	....	680	....	665	....	.....	(730)	....	....	....	660	710	....	No. 2 Gas Coal.
Eagle Coal	....	.....	....	....	....	840	....	.....	.....	....	....	....	....	....	....	Eagle Coal.
Pottsville Series, base	1230	.....	....	1630	....	.....	....	.....	1395	1435	1370	1310	1715	2020	....	Pottsville Series, base.
Big Injun Sand, top	1505	.....	....	2040	1850	.....	....	.....	1865	1745	1670	1620	2125	2580	....	Big Injun Sand, top.

The sections and well records from which the intervals in the accompanying tables were determined are given on subsequent pages in Chapters IV, IX, and X, to which reference is made for details by those desiring to make local investigations. In order to ascertain the approximate position of a coal or other formation at any point in the area, subtract or add, as the case may be, its interval for that region above or below the "key-rock" from the elevation of the latter as shown by the structure contours for the point. If the formation is not listed in the foregoing tables, then its interval may be found in a possible section for that region, all of which are referenced in the Index.

DETAILED STRUCTURE.

General Features.

The strata of Braxton and Clay Counties have only been slightly disturbed or folded as shown by the structure contours on Map II. There is a gradual rise at a very low angle with the horizontal from the northwest margin of the area to the southeast border, with several slight interruptions by low anticlines and shallow synclines. Over a large portion the pitch is not excessive, being barely perceptible to the eye over the steepest structural slope. The lowest point structurally is at the intersection of Bull Run of Cedar Creek with the Braxton-Gilmer County Line, 0.3 mile northwest of Waldeck P. O., where the Pittsburgh Coal has dipped down to 800 feet above sea-level; and the highest is at the common corner of Braxton, Nicholas, and Webster Counties, where the Upper Kittanning Coal has risen to about 1975 feet above the same datum. At the latter point, the horizon of the Pittsburgh Coal should come about 775 feet higher, or at an elevation of 2750 feet, making the total structural relief 1950 feet between the two extremes in an air-line distance of 22½ miles—a dip to the northwest at the rate of 87 feet to the mile.

On the whole the structure harmonizes fairly well with that on the maps previously issued by the Survey in contiguous Counties, except that immediately along the border of

Calhoun and Roane Counties, where the contours of the Washington Coal bed on the map accompanying the Wirt-Roane-Calhoun Report, prepared by the writer and published in 1911, show this seam about 100 feet lower in elevation than it should be along the eastern slope of the Chestnut Ridge Anticline southwestward from Nicut P. O. On pages 212 and 273 of the Report last mentioned, the writer suggested the possibility of a small error in the contours in the immediate region in question, due to the difficulty in finding persistent exposures of known formations and lack of time in covering so large an area in one short field season with untrained assistants.

Attention is also called to an error in the contours of the Pittsburgh Coal on the map accompanying the Kanawha County Report, prepared by C. E. Krebs, and published in 1914. In that portion of the latter county immediately along the Clay line, the contours show the coal 150 to 175 feet lower than it should be. In this locality the Pittsburgh Coal misses the summits of the highest hills by several hundred feet and the error was probably due to the assumption of too small intervals from the known lower formations up to this bed.

In Braxton and Clay, the folds, being roughly parallel to the trend of the Appalachian Mountain System, cause the strike to extend in a northeast-southwest direction except in one or two cases where short anticlinal spurs jut off from the general structural slope. The following attain sufficient prominence to warrant a designation:

Anticlines.	Synclines.
Chestnut Ridge (Warfield).	Grassland.
Sleith Fork.	Tague Fork.
Gassaway.	Gassaway.
Orlando.	Roanoke.
Hansford.	Handley.

Description of Folds.

Chestnut Ridge (Warfield) Anticline. — The Chestnut Ridge Anticline, first named by J. J. Stevenson from a ridge in Fayette County, Pennsylvania, is probably the longest single fold in the State, since the work of the writer in Clay and in the immediately adjoining portion of Kanawha County, as shown by the location of its axis on Map II, connects it up with the Warfield Anticline of White[2], although, between the Clay-Kanawha County Line and Blue Creek in Kanawha, it has died down to a slight monoclinal interruption in the general northwest pitch of the surface strata. In this region the fold would undoubtedly be more pronounced if referred to the Greenbrier Limestone, since the rapid thickening up of the Pottsville Measures southeastward from Elk River would tend to flatten down in a marked degree the surface manifestations of deep-seated folds in this locality. To corroborate this statement is the fact that the base of the Greenbrier Limestone or top of the Big Injun Sand in the Koontz, Davis and Davenport No. 1 Well (227 on Map II), near the crest of this arch on the head of Falling Rock, is 90 feet higher in elevation than in the Ohio Lumber Company No. 2 Well (246 on Map II) 1.6 miles southeastward.

The recent investigations of geologists of the U. S. Geological Survey and State Geological Surveys tend to show the probability that the formation of this arch was synchronous with Appalachian folding, and the formation of the Cincinnati Geanticline, and the Ozark Mountains, concerning which James H. Gardner[3] gives the following interesting data:

> "The writer in recent years has done considerable geologic work in connection with a study of the oil pools that lie along the extension of the Campton Anticline and the Rough Creek uplift, in Kentucky. The result of these observations, added to the work previously done by others, has served to show that there is a zone of disturbance west direction. To the west it connects with the Shawneetown Fault and Bald Hill Uplift, which is shown by F. W. DeWolf on the State geologic map of Illinois as completely crossing southern Illinois into Missouri. To the east it connects with the Warfield-Chestnut Ridge zone of folding, which I. C. White has, with a slight interruption[4], mapped across the State of West Virginia into Pennsylvania, showing the position of it on his State geologic map. From the south line of Pennsylvania, on northward to a point west of Clearfield, this same fold is vouched for by R. R. Hice, State Geologist of Pennsylvania.
>
> "The distance now known to be traversed by this structure is approximately 560 miles. From Pennsylvania southward it is one of several anticlines produced by Appalachian folding, but in the Big Sandy Valley along the border line of West Virginia and Kentucky,

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[2] I. C. White, "Science," July 17, 1885; and Vol. I, W. Va. Geol. Survey, p. 276; 1899.

[3] Bulletin of the Geological Society of America, Vol. XXVI, pp. 477-483; 1915.

[4] This interruption is shown above as not existing.—R. V. H.

it swings westward along the Ohio Valley crossing near the crest of the Cincinnati arch and continuing across Kentucky and Illinois to the Ozark Uplift. Surely, it shows some sort of structural relationship between Appalachian structure and these other large uplifts to the west."

In the territory of this Report, the axis of the arch enters Clay County from Kanawha, 0.6 mile southwest from the common corner of Roane, Kanawha, and Clay Counties; bears in a southerly direction; crosses Elk River about midway between Camp and Procious; Porter Creek, 1 mile below Bomont; the Clay-Kanawha Line, at its intersection with Peters Fork of Falling Rock Creek; and continues its southwest course in Kanawha County to a connection with the terminus of the Warfield Anticline as limited by C. E. Krebs[5], 0.2 mile west of the mouth of Eightmile Fork of Campbell Creek.

Along its axis in Clay County, the surface rocks belong in the Conemaugh, Allegheny, and Pottsville Series, the Kanawha Group of the latter only being represented and the different divisions succeeding each other in the order designated southwestward. The formation of the fold probably took place during the general upheaval in the Appalachian region at the close of Carboniferous time.

Where the axis first intersects the Clay-Kanawha Line, near the head of Upper King Shoal Run, the Upper Kittanning Coal has an elevation of about 800 feet above sea-level. From this point it rises southwestward and brings the same coal up to an elevation of about 910 feet at Elk River; 945 feet, on Porter Creek; and 1060 feet above sea-level, at its intersection with the Clay-Kanawha Line.

Grassland Syncline. — The Grassland Syncline of the writer[6] is the basin lying immediately on the east of the fold last described. Its course southwestward from its type locality in Harrison County to the territory of this Report has been described by D. B. Reger[7]. Its axis enters Braxton County 2 miles southwest of Rosedale on an almost due south course

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[5] Geologic Map Accompanying Kanawha County Report, W. Va. Geol. Survey; 1913.

[6] Ray V. Hennen, Doddridge-Harrison Report, W. Va. Geol. Survey, p. 65; 1912.

[7] Lewis-Gilmer Report, W. Va. Geol. Survey, pp. 41-42; 1916.

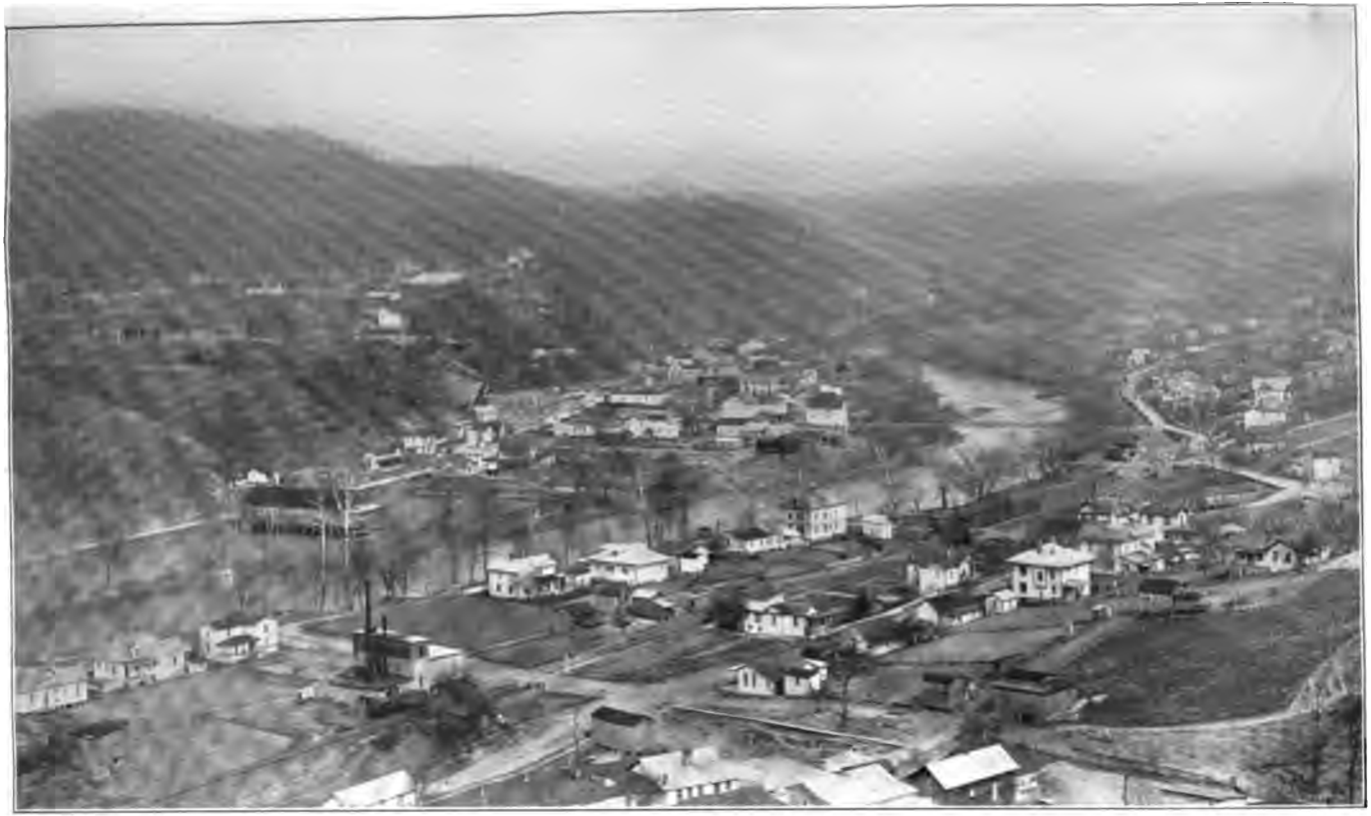

PLATE II.—Showing town of Sutton, County-Seat of Braxton, looking east up Elk River, and topography of Conemaugh and Allegheny Series.

from the **Rosedale Basin** of Reger—described on page 42 of the Report last referenced—veers to the southwest, follows closely along the Calhoun County Line, crosses into Calhoun one mile northwest of Nebo; into Roane, 0.7 mile northwest of the common corner of Calhoun, Roane, and Clay Counties; and into the latter County near Wallback. On entering Clay it continues its southwest course; intersects Horner Fork, 0.4 mile west of Reed Fork; Elk River, 1 mile below the mouth of Twistabout Creek; Porter Creek, ¾ mile south of Bomont; and the Clay-Kanawha County Line at the mouth of Grasslick Branch of Falling Rock Creek.

The surface rocks along its axis belong in the Monongahela, Conemaugh, Allegheny, and Pottsville Series, the Kanawha Group of the latter only being represented and the different divisions succeeding each other southwestward in the order named. The age of the fold is synchronous with that of the Chestnut Ridge Anticline.

On the axis at the Gilmer-Braxton Line, the Pittsburgh Coal—the "key-rock" on which the structure contours are based in that region—has an elevation of about 965 feet above sea-level. The axis rises rapidly southward, bringing the coal up to about 1100 feet on Left Fork, where it flattens down into a low depression just northwest of Lydia P. O., carrying the coal down to about 1050 feet. At its intersection with Stinson Fork, the axis again resumes its rapid southwest rise and at the southern limit of Pittsburgh Coal contours, 2 miles northeast of Wallback, the latter seam has an elevation of about 1270 feet and the Upper Kittanning Coal, 500 feet above sea-level. The rapid rise along the axis continues southwestward to Elk River, bringing the latter bed up to about 910 feet above sea-level, and then flattens down for about 3 miles, the Upper Kittanning Coal having an elevation of only about 945 feet at its intersection with Porter Creek and the present developed Big Injun Sand oil pool of this immediate region occurring on the flattened bottom of the Basin. Beyond Porter Creek, the axis rises more rapidly and brings the coal last mentioned up to about 1050 feet above sea-level, only 10 to 20 feet lower in elevation than on the crest of the Chestnut Ridge Anticline, ¾ mile northwestward.

Sleith Fork Anticline.—The Sleith Fork Anticline, not previously described, is a low arch or spur jutting off the general northwest structural slope in the western edge of Otter and Birch Districts, Braxton County, and lies immediately to the east of the syncline last described. Its northeastern terminus is near Progress on Crooked Fork of Steer Creek, from which point it bears southwestward and crosses O'Brien Creek just below the mouth of Triplett and Steer Creeks, at the mouth of Sleith Fork from which stream it is herein named. Southwestward for 3½ miles it follows closely along the valley of Sleith Fork, then veers to the south and finally dies out in the general slope, 1 mile southeast of Elmira. The fold is fairly symmetrical about its axis.

The surface rocks along its crest belong in the Dunkard, Monongahela, and Conemaugh Series exclusively. At Progress the Pittsburgh Coal has an elevation of about 940 feet above sea-level on its crest, but southwestward the axis rises rapidly on the nose of the fold, bringing the latter coal up to 980 feet above sea-level at O'Brien Creek; 1055 feet, at the mouth of Sleith Fork; and 1215 feet, 1 mile southeast of Elmira.

The age of the fold is probably synchronous with that of the Chestnut Ridge Arch.

Tague Fork Syncline.—The Tague Fork Syncline is a low downward fold lying immediately on the east of the arch last described, in western Braxton County, and has not been previously named. It is herein designated from the stream on which the axis attains its lowest elevation. From its northeastern terminus, 1½ miles northwest of Davison, its axis bears southwestward, crosses O'Brien Fork, 0.6 mile north of Mudlick Fork; Tague Fork, 1 mile above its mouth; Steer Creek, 0.2 mile northwest of the mouth of Dry Fork; and Sleith Fork, 0.1 mile below the mouth of Doggs Fork, and terminates in less than one mile to the southwest. The fold is fairly symmetrical about its axis.

The outcropping rocks along this Basin are the same as given for the crest of Sleith Fork Anticline. At its northeastern end, the Pittsburgh Coal has an elevation of about 950 feet above sea-level. Southwestward along the axis the same bed dips down to about 930 feet above the same datum in a local depression on Tague Fork. Continuing southwest the axis rises rapidly, bringing this coal up to about 1015 feet at its intersection with Steer Creek; 1140 feet, with Sleith Fork; and 1200 feet, on the head of Doggs Fork. The age of this fold is synchronous with that of the Sleith Fork Anticline, since it is a result of the same forces.

Gassaway Anticline.—The Gassaway Anticline, not previously described, is a low arch or spur off the general northwest structural slope at almost right angles to the direction of the prevailing strike in both counties. Its northwest terminus is on the head of Crooked Fork of Right Fork of Steer Creek, from which point it bears south 15° to 20° east for a distance of 9 to 10 miles; passes 0.3 mile west of Clickton; crosses Elk River just above the mouth of Rockcamp Run, 2 miles southwest of Gassaway, from which town it has been named; and finally terminates near the summit of Coon Knob. The fold is fairly symmetrical about its axis.

The surface rocks belong in the Monongahela, Conemaugh, and Allegheny Series, the different divisions succeeding each other in the order named southwestward. On the head of Crooked Fork, the Pittsburgh Coal has an elevation of about 1100 feet above sea-level. The axis rises rapidly up to the **nose** of the fold southeastward into a structural dome just west of Clickton, bringing the Upper Kittanning Coal up to about 760 feet above the same datum. Continuing southeastward, the axis dips gently, bringing the same coal down to about 700 feet above sea-level at its intersection with Elk River and Coon Creek, where it resumes its rapid southeast rise and at Coon Knob has elevated the Upper Kittanning up to about 930 feet above sea-level.

The formation of this fold is probably contemporaneous with that of the Chestnut Ridge Anticline, described on a preceding page of this Chapter.

Gassaway Syncline.—The Gassaway Syncline, not previously described, is a low downward fold—9 to 10 miles in length—lying immediately on the east side of the anticline last discussed and having its northeast terminus 1.5 miles southward from Delta, Braxton County. From this locality, the axis bears south 10° to 15° west, passing through the mouth of Venison Fork of Perkins Fork and near Riffle; crosses Elk River at Gassaway, from which town it has been named; and finally terminates one to two miles southwestward in the general northwest dip of the strata.

The surface rocks along this Basin are in the Dunkard, Monongahela, and Conemaugh Series exclusively, the different divisions succeeding each other southwestward in the order named. At the northeast end of the axis, as shown on Map II, the Pittsburgh Coal has an elevation of about 1075 feet above sea-level. From this point the axis rises slowly to the southwest and at the southern limit of Pittsburgh Coal contours (see Map II) has elevated the latter seam up to about 1260 feet and the Upper Kittanning bed, to 500 feet above the same datum. Beyond this point the rise is more rapid to the southwest, the latter coal being elevated to about 560 feet at the mouth of Little Otter Creek and 700 feet, at slightly less than 2 miles from Elk River. The age of this fold is synchronous with that of the anticline of the same name, described above.

Orlando Anticline.—The Orlando Anticline of Reger[6] is a comparatively low upward fold, crossing Salt Lick District, Braxton County. It enters the latter area from Lewis, one mile north of Orlando, bears southwestward 4½ miles, crossing Oil Creek at the mouth of Road Fork, and the Little Kanawha River, 1.5 miles southeast of Burnsville, and, at three-fourths mile beyond the latter stream, veers to an almost due south course, passing through Rollyson and Heaters, and practically dies out 1¼ miles northeast of Flatwoods in the general northwest dip of the rocks. Its total length in Braxton County is 10 to 11 miles, and it is almost symmetrical about its axis, the dip being slightly more rapid and prolonged a much greater distance on the western slope.

The surface rocks are those of the Dunkard, Monongahela, and Conemaugh Series, the different divisions succeeding each other southwestward in the order named. On its crest at the Lewis-Braxton Line, the Pittsburgh Coal has an elevation of about 1055 feet above sea-level. For 3¾ miles southwestward, the axis remains almost horizontal to the Little Kanawha River, where it starts to rise rapidly southward, bringing the Pittsburgh Coal up to about 1140 feet above sea-level at its intersection with Grass Run; 1185 feet, with Saltlick Creek; 1220 feet, at Rollyson; and about 1260 feet above the same datum at the southern limit of Pittsburgh Coal contours (see Map II), the Upper Kittanning Coal having an elevation of about 500 feet as shown by its contour for the same point. Southward the latter coal is elevated to about 625 feet above sea-level at the southern terminus of the axis as drawn on Map II.

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[6] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, p. 40; 1916.

Its age is probably synchonous with that of the Chestnut Ridge Anticline, described on a preceding page of this Chapter.

Roanoke Syncline.—The Roanoke Syncline of Reger[9] is a fold in northeastern Braxton, lying immediately southeast of the anticline last described. Its total length is about 23 miles, 12 of which is in the latter county and the balance in Lewis. The axis enters Braxton from Lewis at the mouth of Meadow Run, 2 miles east of Orlando; bears southwest for 6½ miles, crossing the Little Kanawha River, ¼ mile west of the mouth of Knawl Creek, and Long Run, ¾ mile northwest of Wine Gap; veers slightly to the southeast, intersecting Saltlick Creek at Saltlick Bridge; and finally dies out in the general northwest slope, 1.8 miles southeast of Flatwoods. The Basin is non-symmetrical about its axis, the slope on the eastern side being much steeper and more prolonged.

The surface rocks belong exclusively in the Dunkard, Monongahela, and Conemaugh Series, the different divisions succeeding each other southwestward in the order named. On the axis at the Lewis-Braxton Line, the Pittsburgh Coal has an elevation of about 975 feet above sea-level. The axis rises gently southwestward to the Little Kanawha, bringing the latter coal up to about 1025 feet at the River. The axis now rises more rapidly southward, bringing the same bed up to about 1175 feet, on the head of Long Run; and 1255 feet, just south of Saltlick Bridge, the Upper Kittanning Coal having an elevation of about 500 feet at this point. Continuing southward along the axis, the latter bed had been elevated up to about 750 feet above sea-level at the southern terminus of the fold as outlined on Map II. Its formation is a direct result of the Orlando Anticline, described above, and for that reason is of the same age.

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[9] D. B Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, pp. 42-3; 1916.

Hansford Anticline.—The Hansford Anticline of Krebs[16] is an important structural feature of Clay County, since its total length in the latter area is about 28 miles. Its axis enters Clay from Kanawha County, 1.2 miles northwest of Bird Knob, bears northeast, and intersects Sycamore Creek just above the mouth of Adonijah Fork, where it veers more to the east to near the road fork on the head of Charley Branch. From the latter point it bears almost due north to a point just east of Schoonover Knob, closely following the valley of Beech Creek; veers to the northeast, crossing Elk River about one-half mile below the mouth of the former stream; Little Laurel Run, 1.5 miles above its mouth; Otter Creek, 0.5 mile northeast of Ivydale, where it changes to an almost due east course for 3¼ miles to its intersection with Jumping Gut, ¼ mile above the mouth of the latter. From this point it again resumes a northeast course and finally terminates about one mile east of Villa Nova. This fold is known locally in Clay as the "Shelton Anticline" from a town on Elk River through which it was supposed to pass, but in reality being 3½ miles to the westward from the axis of this arch. The name "Hansford", however, holds by right of priority in official publications. The fold is non-symmetrical about its axis, the dip of the rocks on the western slope being generally steeper and prolonged a greater distance.

The outcropping rocks along its crest belong exclusively in the Conemaugh, Allegheny, and Pottsville Series, the Kanawha Group of the latter only being represented. Its age is probably synchronous with that of Chestnut Ridge Arch, described on a preceding page of this Chapter.

On its crest at its intersection with Elk River, ¾ mile southeast of Villa Nova, the Upper Kittanning Coal — the

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[16] C. E. Krebs, Kanawha County Report, W. Va. Geol. Survey, p 61; 1914.

"key-rock" on which the structure contours are based in this portion of the area, has an elevation of 810 feet above sea-level. The axis rises rapidly southwestward along a nose in the fold into a low structural dome at its intersection with Jumping Gut, bringing the coal last mentioned up to slightly over 1000 feet above sea-level. The same bed remains almost horizontal along the axis to a point about one mile west of Little Laurel Run, where it again rises rapidly southwestward up to about 1100 feet above the same datum, ½ mile southwest of Maysel. The axis continues to rise gently southwest, bringing the same coal up to about 1140 feet above sea-level at Elk River, where it again resumes a rapid rise into a structural dome on the head of Charley Branch of Sycamore Creek, elevating the "key-rock" up to about 1275 feet. Westward from the latter region to the Clay-Kanawha Line, the axis remains almost horizontal, the Upper Kittanning Coal ranging from 1240 to 1260 feet above sea-level and only 20 to 30 feet higher than the axis of the Handley Syncline immediately on the southeast.

Handley Syncline.—The Handley Syncline of Krebs[11] is a low downward fold lying immediately on the southeast of the anticline last described and being synchronous with it in time of formation. It extends entirely across Clay and 3½ miles into Braxton County. The axis enters the former, 1¼ miles southwest of Bird Knob, bears northeast, passing just southeast of Crosby and crossing Sycamore Creek, 0.5 mile southeast of the mouth of Right Fork, and at 2 miles northeast of the latter point it changes to a north 10° to 20° east course, following closely along the valley of Middle Creek, and intersecting Elk River, 0.4 mile east of the mouth of the former stream. From the latter point the axis continues a northeast course closely along the west side of Elk to a point immediately south of Ivydale, where it veers to an almost east course closely along the south side of the same river to its intersection with Jumping Gut, 0.5 mile northeast of the summit of Bragg Knob. Here it resumes a northeast course, passing near the mouth of Strange Creek and terminating at Glendon at the mouth of Birch River. This Basin is non-symmetrical about its axis, in that its southeastern slope is steeper and prolonged a much greater distance.

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[11] C. E. Krebs, Kanawha County Report, W. Va. Geol. Survey, p 63; 1914.

The outcropping rocks along the axis belong exclusively in the Conemaugh, Allegheny, and Pottsville Series, the Kanawha Group of the latter only being represented. At Glendon the Upper Kittanning Coal has an elevation of only about 710 feet above sea-level, but southwestward the axis rises rapidly, bringing this bed up to about 820 feet at Strange Creek Station, and 980 feet at Groves Creek. Westward from the latter stream, the axis remains almost horizontal to its intersection with Elk River, 0.5 mile southeast of Ivydale, where it dips rapidly southwestward into a marked depression in the general floor of this Basin, just east of Spread, bringing the Upper Kittanning Coal down to about 920 feet above sea-level. Here it again resumes a rapid southwest rise, bringing the latter seam up to about 1000 feet at the mouth of Two Run; 1070 feet, opposite the mouth of Leatherwood; and 1225 feet, at the forks of Carver (Cottrill) Fork of Middle Creek. Southwestward from the latter point, the axis remains almost horizontal to the Clay-Kanawha County Line, where the coal last mentioned has an elevation of about 1210 feet above sea-level and at no point is much over 30 to 40 feet below its height on the crest of the Hansford Anticline, from ½ to 2 miles northward.

Unconformities and Absence of Faults.

There are numerous points in both Braxton and Clay where the exposed beds of the Kanawha Group of the Pottsville reveal slight local unconformities by the temporary absence of coal beds and sandstone ledges, which cause a considerable variation of interval between well-known members. These, however, are rather limited in extent and do not warrant further description. As shown by the logs of oil and gas well borings, there is a widely extended unconformity below drainage at the junction of the Pottsville and Mauch Chunk Red Beds, the latter being the topmost formation of the Mississippian. That a considerable period of time elapsed from the close of the latter period before the deposition of Pottsville sediments is evidenced by the marked contrast in the conditions of sedimentation, the soft red shales of the former being succeeded by heavy, coarse, gray to grayish-white, and current-bedded sandstones and several coal seams. The unconformity along this junction-plane is further corroborated by the wide variation in thickness of the Mauch Chunk Series as shown by the well records, a feature that can hardly be explained on any other basis than a long period of erosion immediately preceding Pottsville time.

There appears to be a complete absence of faults in the territory of this Report, as none were observed, the structural slope probably being too gentle to favor their formation.

CHAPTER IV.

STRATIGRAPHY—SPECIAL SECTIONS.

INTRODUCTION.

In Braxton and Clay Counties, the surface rocks, with the exception of the Quaternary deposits of alluvial sand, gravel, and clay along the valley floors of the larger streams, are all of the Paleozoic Age, belonging exclusively in the Permo-Carboniferous and Pennsylvanian, all the divisions of the latter being represented. There is also abundant evidence available through the logs of many borings for oil and gas as to the thickness and character of the strata below drainage, including the rocks of the Mississippian and Upper Devonian.

The following is a classification of the beds available for study, arranged in descending order:

Age.	Period.	Series.
Quaternary	Recent	Present Formation.
	Pleistocene	River Terrace Deposits.
Paleozoic	Permo-Carboniferous	Dunkard (200-250 ft.).
	Pennsylvanian	Monongahela (425 ft.).
		Conemaugh (630 ft.).
		Allegheny (250-385 ft.).
		Pottsville (950-1560 ft.).
	Mississippian	Mauch Chunk (150-575 ft.)
		Greenbrier Limestone (40-230 ft.).
		Pocono Sandstones (400-450 ft.).
	Devonian	Catskill (500-760 ft.).
		Chemung (956 ft.).

The Dunkard Series is generally recognized as of Permo-Carboniferous Age, and represents a transitional stage between the Permian and Pennsylvanian. As shown on Map II, these cap the hills and ridges in northwestern Braxton and the northern point of Clay County. Since these deposits occur high up, their beds are not well exposed by intersection with streams and public highways, so that the information concerning their detailed stratigraphy is meager, making it difficult to differentiate these more or less isolated beds. Hence, the members will be described briefly in Chapter V, along with those of the Monongahela Series.

The great bulk of the surface rocks are those of the Pennsylvanian Period, all the four divisions—Monongahela, Conemaugh, Allegheny, and Pottsville—being represented and succeeding each other in the order named southeastward across the area. The Kanawha Group only of the latter formation is exposed at the surface.

A large number of sections, showing the thickness, character, and succession of the strata, were measured with both aneroid and spirit level at scattered points in each county. These have been supplemented with the logs of diamond drill borings and oil and gas wells, wherever possible, all of which will now be given in this Chapter by magisterial districts.

BRAXTON COUNTY SECTIONS.

Salt Lick District.

The following section was measured with aneroid by Gawthrop in the northern edge of Salt Lick District, southward along the hill road from the summit of a high knob on the Gilmer-Braxton Line. The intervals are slightly less than they should be, owing to the rise of the strata in the same direction:

Section 1.5 Miles Northwest of Burnsville, Salt Lick District.

	Thickness. Feet.	Total. Feet.	
Dunkard Series (215')			
Concealed from top of knob	135	135	
Sandstone, massive, coarse-grained, grayish-brown, pebbly, makes cliff, Mannington (1350' B.)	40	175	175'
Shale, siliceous?	5	180	
Concealed	5	185	

	Thickness. Feet.	Total. Feet.	
Coal, trace, Waynesburg "A"	0	185	
Sandstone, massive, coarse-grained, grayish-brown, **Waynesburg** (1310′ B.)	30	215	40′
Monongahela Series (350′)			
Concealed	5	220	
Shale, red	5	225	
Concealed with sandstone and shale	69	294	
Fire clay shale	1	295	
Shale, red and gray	30	325	
Concealed	45	370	
Shale, red	10	380	
Concealed	5	385	
Sandstone, massive, coarse-grained, gray, pebbly cliff, **Upper Sewickley**	50	435	220′
Concealed	70	505	
Shale, red	10	515	
Shale, red and gray, with thin layers of sandstone	30	545	
Sandstone	5	550	
Concealed, mostly shale to bench, **Pittsburgh**	15	565	130′
Conemaugh Series (140′)			
Concealed in bench	45	610	
Sandstone, massive, partly concealed	30	640	
Concealed, with red shale and sandstone	60	700	
Shale, red, to bed of run (820′ B)	5	705	140′

In the northeast edge of the same District, the following section was measured with hand-level by D. B. Reger, supplemented with the log of the R. P. Waters Heirs No. 4 Well (18 on Map II) and published on pages 69 and 70 of the Lewis-Gilmer Report of the State Geological Survey, just issued. That portion above the well mouth was measured along the steep hill just east of Orlando Station on the Coal and Coke Railway, the main features of which were verified by the writer in the field during 1915:

Orlando Section, Braxton-Lewis County Line.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (338′)			
Sandstone, partly concealed, capping knob, **Gilboy** (1345′ L.)	30	30	30′
Concealed	54	84	
Sandstone, flaggy, green, **Uniontown**	6	90	
Shale, red, partly concealed	56	146	
Sandstone, shaly, **Arnoldsburg**	10	156	
Concealed, with reds, along slope	27	183	
Sandstone, massive, pebbly, cliff rock, **Upper Sewickley** (1167′ L.)	25	208	178′
Steep bluff with thin sandstones and variegated shale	80	288	

	Thickness. Feet.	Total. Feet.	
Concealed in bench, Redstone Coal horizon	5	293	
Concealed and sandstone in bluff	45	338	
Spring, Pittsburgh Coal horizon (1037′ L.)	...	338	130′
Conemaugh Series (610′)			
Concealed	28	366	
Sandstone, shaly, Lower Pittsburgh	20	386	
Shale, sandy	38	424	
Sandstone, gray, medium-grained, Connellsville	12	436	
Shale, red, partly concealed	57	493	
Sandstone, massive, Lower Connellsville	15	508	
Shale, red	30	538	
Coal, slaty, "Normantown"	1	539	201′
Fire clay shale	3	542	
Sandstone, shaly, Morgantown	15	557	
Shale, red	6	563	
Shale, sandy	2	565	
Shale, greenish, sandy, with small fossil shells	6	571	
Slate, dark (0′ 2″)	...	571	
Limestone, shaly, Orlando	3	574	
Shale	3.5	577.5	
Coal, Elk Lick	0.5	578	39′
Shale, variegated, to Coal & Coke Ry. grade, Birmingham	15	593	
Concealed to Oil Creek	10	603	
Continued in Water Heirs No. 4 (18 on Map II) Well Record:			
Unrecorded	135	738	
Coal, Bakerstown	5	743	165′
Unrecorded	20	763	
Sand, Little Dunkard	25	788	
Unrecorded	50	838	
Sand, Big Dunkard, and unrecorded	110	948	205′
Allegheny and Pottsville Series (740′)			
Unrecorded	740	1688	740′
Mauch Chunk Series (180′)			
Sand, Maxton (gas, 75′ in)	150	1838	
Unrecorded	20	1858	
Little Lime	10	1868	180′
Greenbrier Limestone (70′)			
Big Lime	70	1938	70′
Pocono Sandstones (325′)			
Big Injun Sand	235	2173	
Unrecorded	90	2263	325′
Catskill Series (370′)			
Unrecorded	250	2513	
Sand, Thirty-foot	25	2538	
Unrecorded	13	2551	
Sand, Gordon Stray (gas, 6′ in)	11	2562	
Unrecorded	15	2577	
Sand, Gordon	30	2607	
Unrecorded to bottom	26	2633	370′

"Gas test, 65/10 mercury in 2″ opening; volume, 1,400,000 cu. ft. daily. Total depth of hole, 2195′."

In the above section the thickness of the Pocono Sandstones was supplied from the log of R. P. Waters No. 3 Well, located one-fourth mile southeast of No. 4 on the same tract. The writer has made some slight changes in the section by taking 70 feet from the thickness of the Allegheny and Pottsville and adding it to the Conemaugh Series, which is in harmony with determinations for the latter formation in the immediate region.

The following section was measured with hand-level by Gawthrop and the writer down the north hillside of Little Kanawha River:

Section 1.2 Miles East of Burnsville, Salt Lick District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (134')			
Sandstone, massive, fine-grained, micaceous, greenish, **Morgantown**	30.0	30.0	
Shale, reddish-brown	8.3	38.3	
Coal blossom, Normantown	0.2	38.5	38.5'
Shale, green, limy	3.0	41.5	
Limestone, **Orlando**	1.0	42.5	
Shale, partly concealed	46.5	89.0	
Sandstone, massive, gray, **Grafton**	30.9	119.9	
Shale, dark-green, marine fossils abundant, Ames	4.0	123.9	
Coal, Harlem (755' B.)	0.1	124.0	85.5'
Shale in road and concealed to Little Kanawha River	10.0	134.0	10.0'

In the foregoing section, the limestone at 41.5 feet from the top is absolutely the same as that designated "Orlando" by Reger in the section given above for Orlando.

Slightly over a mile northwestward in Salt Lick District, the following section was measured with hand-level by D. B. Reger, supplemented with the log of the Marshall No. 1 Well (No. 44 on Map II), just opposite the Baltimore and Ohio Railroad station at Burnsville, and published on pages 92-3 of the Lewis-Gilmer Report of the State Geological Survey. The portion above the well mouth was determined from the top of a high hill northward to the mouth of Shreve Run. The well in question was drilled by Ward et al. and the log previously published by the Survey in 1904 on page 391 of Volume I(a). Owing to the northwestward dip of the rocks, the well mouth is at a higher stratigraphic level than the bottom of the measured portion; hence, in order to make a proper connection, an interval of 31 feet was omitted from the top of the well record. The region was visited by the writer during 1915 and the main features verified. Assuming the normal thickness in this region for the Conemaugh and Allegheny Series, the top of the Pottsville should come at least 100 feet higher in the measures than shown in the original section, thus making the great sandstone mass, at 1424 feet from the top, correlate with the Upper and Lower Connoquenessing. Other corrections in names suggested are shown in parentheses:

Burnsville Section, Salt Lick District.

	Thickness. Feet.	Total. Feet.	
Dunkard Series (135')			
Sandstone, brown, micaceous, capping knob, **Mannington**	15	15	
Shale, variegated	20	35	
Shale, sandy	15	50	
Sandstone, brown, pebbly cliff rock.....27' Concealed, with sandy shale.....33 Sandstone, massive, brown, pebbly, cliff rock.....25 } **Waynesburg** (1350' B.)	85	135	135'
Monongahela Series (340')			
Concealed	22	157	
Sandstone, flaggy, **Gilboy**	16	173	
Concealed	22	195	
Concealed in steep bank, **Uniontown Sandstone** horizon	17	212	77'
Concealed along slope, mostly reds	16	228	
Concealed in steep bank	22	250	
Concealed along slope, mostly reds	45	295	
Sandstone, pebbly.....25' Concealed and sandy shale 5 Sandstone, massive, pebbly.30 } **Upper Sewickley**	60	355	143'
Concealed, mostly sandy shale	32	387	
Sandstone, flaggy, **Cedarville**	28	415	
Concealed	5	420	
Bench, **Redstone Coal horizon**	...	420	
Concealed	15	435	
Sandstone, flaggy, **Weston**	30	465	
Concealed	10	475	
Fire clay spring on bench, **Pittsburgh Coal horizon** (1010' B.)	...	475	120'
Conemaugh, Allegheny, and Pottsville Series (1659')			
Concealed along steep slope	45	520	
Sandstone, shaly, in steep bluff (**Lower Pittsburgh**)	37	557	

	Thickness. Feet.	Total. Feet.	
Concealed along slope, with reds............	33	590	
Sandstone, shaly, makes cliff along hill, **Connellsville**	18	608	
Concealed in slope, mostly red shale.......	30	638	
Concealed in steep bluff (**Lower Connellsville**) Sandstone horizon...............	25	663	
Concealed in slope........................	35	698	
Sandstone, shaly, **Morgantown**..............	15	713	
Shale, reddish-green, with plant and (marine?) fossil shells.....................	10	723	
Dark slate	...	723	
Shale, sandy..............................	3	726	
Limestone, hard, **Orlando**..................	1	727	252′
Shale, variegated..........................	3	730	
Concealed to river........................	10	740	
Continued in Marshall No. 1 Well (44 on Map II) Record:			
Sand, white, hard, (water), **Grafton**.........	40	780	
Red rock, soft...........10′ Slate, blue, soft.........10 Red rock, soft (cave).....30 } **Pittsburgh Reds**	50	830	
Lime, hard................................	24	854	
Slate, red rock, and shell (water and cased)	365	1219	
Sand, white and soft, coarse, with pebbles...	40	1259	
Lime, blue, hard........................	15	1274	
Sand, gray...............................	25	1299	
Slate and shells, white and soft............	25	1324	
Lime, gray, hard.........................	25	1349	
Slate and shells, white and soft............	75	1424	697′
Sand, white, hard..115′ Sand, gray, hard... 50 } **Upper and Lower Connoquenessing**	165	1589	
Lime, shells, and slate....................	120	1709	
Sand, white, hard, Salt....................	50	1759	
Slate and shells..........................	70	1829	
Lime, white..............................	20	1849	
Slate and shells, blue, hard................	50	1899	
Lime, white, hard.........................	25	1924	
Sandstone, white, **Salt of Rosedale**, (oil and gas, 192′ in).........................	210	2134	710′
Mauch Chunk Series (210′)			
Slate, black, soft.........................	25	2159	
Sand, white, hard.........................	40	2199	
Lime	50	2249	
Red rock, soft............................	95	2344	210′
Greenbrier Limestone (40′)			
Big Lime, gray, hard.....................	40	2384	40′
Pocono Sandstones (317′)			
Sand, **Big Injun**, grayish-white and hard (show of oil and gas).................	42	2426	
Limestone?, gray.........................	200	2626	
Slate and shells, blue, soft................	20	2646	
Sand, gray, hard..........................	30	2676	
Slate, black, soft.........................	20	2696	
Sand, white, hard, **Berea** (little oil).........	5	2701	317′
Catskill Series (290′)			
Slate and shells, blue and soft, to bottom...	290	2991	290

The following short section, in the eastern border of Salt Lick District, was measured with aneroid by Gawthrop northeastward on the south hillside of Knawl Creek, just above the mouth of Left Fork, and corroborates the interval indicated on a preceding page in the Orlando Section between the Bakerstown Coal and the base of the Conemaugh Series:

Section 0.3 Mile Southeast of Knawl, Salt Lick District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (204')			
Concealed and slate	3	3	
Coal, hard, Bakerstown (1030' B.)	2	5	5'
Shale and concealed	40	45	
Sandstone	10	55	
Concealed	45	100	
Sandstone, massive, hard, fine-grained, greenish-gray	5	105	
Concealed	30	135	
Sandstone, massive top, flaggy base, **Lower Mahoning**	35	170	
Concealed, mostly gray, sandy shale	30	200	
Sandstone, flaggy, greenish-gray	4	204	
Allegheny Series (1')			
Coal (reported), Upper Freeport (830' B.)	1	205	200'

The following interesting section of the underground strata is obtained from the log of the G. D. Walton No. 1 Well (52 on Map II), located on the south bank of Knawl Creek, 1 mile eastward from the mouth of Pigeonroost Fork and 2 miles west of Ireland. According to Gawthrop, the well was drilled by E. G. Davisson and starts 10 to 15 feet below the crop of the Upper Freeport Coal at Exposure No. 282 on Map II. The record was furnished by John B. Corrin of the Hope Natural Gas Company, the well having only a slight trace of oil and gas at 46 feet in the Big Lime:

Head of Knawl Creek Section, Salt Lick District.

(Log of G. D. Walton No. 1 Well—52 on Map II).

	Thickness. Feet.	Total. Feet.	
Allegheny Series (230')			
Conductor	12	12	
Sand, Upper Freeport	63	75	
Coal, Lower Freeport	2	77	77'

	Thickness. Feet.	Total. Feet.	
Hard sand and lime	123	200	
Slate	6	206	
Sand, East Lynn	22	228	
Coal, Lower Kittanning	2	230	153'
Pottsville Series (734')			
Sand, Homewood (10" casing, 276' 8")	47	277	
Slate	8	285	
Sand	35	320	
Slate	68	388	
Sand and lime	122	510	
Slate	5	515	
Lime	10	525	
Sand	15	540	
Slate	30	570	
Sand and lime, very hard	113	683	
Coal, Campbell Creek? Powellton?	3	686	456'
Sand	89	775	
Slate	1	776	
Lime	34	810	
Slate	23	833	
Coal, Lower War Eagle?	2	835	149'
Sand, Nuttall? (8" casing, 888' 8")	70	905	
Slate	5	910	
Coal	7	917	82'
Slate	10	927	
Sand	37	964	47'
Mauch Chunk Series (198')			
Red rock	16	980	
Lime	35	1015	
Red rock	130	1145	
Slate	17	1162	198'
Greenbrier Limestone (138')			
Big Lime (slight trace of oil and gas, 1208')	50	1212	
Slate	8	1220	
Big Lime	80	1300	138'
Pocono Sandstones (406')			
Big Injun Sand	132	1432	
Slate	60	1492	
Squaw Sand	8	1500	
Slate	48	1548	
Gantz? Sand (Weir)	35	1583	
Slate	88	1671	
Sand	11	1682	
Slate	14	1696	
Sand, **Berea**	10	1706	406'
Catskill and Chemung Series (758')			
Red rock	6	1712	
Sand, Gantz	4	1716	
Red rock	14	1730	
Sand, with small breaks of slate	90	1820	
Slate, Fifty-foot and Thirty-foot	40	1860	
Sand, Gordon Stray	5	1865	
Slate	78	1943	
Sand, Gordon	17	1960	
Slate	64	2024	

	Thickness. Feet.	Total. Feet.	
Sand, **Fourth**	8	2032	
Slate	27	2059	
Fifth Sand	2	2061	
Slate	154	2215	
Sand, Bayard	8	2223	
Slate and shells to bottom	241	2464	758'

Just across the Braxton Line in the edge of Lewis County, the following section was obtained by D. B. Reger, supplemented with the log of the A. K. Wilson No. 2 Well (56 on Map II)—drilled by Wilson and Butcher near the Little Kanawha River, 1 mile east of Bablin—and published on pages 71-3 of the Lewis-Gilmer Report of the State Geological Survey. It is of special importance for the territory of this Report, in that the position of the Kanawha Black Flint marine fossil horizon is shown with reference to the Lower Kittanning Coal. That portion above the well mouth was measured with hand-level by Mr. Reger, along the steep east hillside of Glady Creek, 1 mile north of Bablin, at the exposure of the fossil horizon mentioned. This point was visited during 1915 by the writer and the measurements between the Stockton and Lower Kittanning Coals verified. The coal blossom at the top appears to represent the Brush Creek instead of the Bakerstown, as shown in the section as published in the Report above mentioned and for that reason the base of the Conemaugh is herein placed 95 feet higher in the measures. This makes the sandstone, the base of which comes 220 feet from the top of the section, the Upper Freeport ledge instead of the Mahoning:

Bablin Section, Lewis County.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (135')			
Coal blossom, on top of knob, (Brush Creek), (1580' B.)	...	....	
Concealed, with ferriferous nodules	5	5	
Shale, sandy, greenish, with plant fossils	15	20	
Concealed, mostly shale	115	135	135'
Allegheny Series (195')			
Concealed in bench, **Upper Freeport Coal horizon)**	10	145	
Concealed in steep bluff, with sandstone, Upper **Freeport**	75	220	

	Thickness. Feet.	Total. Feet.	
Shale, gray, with plant fossils	10	230	
Concealed	36	266	
Slate, black, **Upper Kittanning Coal horizon**	...	266	131'
Concealed	35	301	
Sandstone, massive, **Upper East Lynn**	20	321	
Coal 2' 0" Slate, black 0 4 Coal, visible 1 7 } **Lower Kittanning** (3' 11") (1255' B.)	4	325	59'
Concealed	5	330	
Pottsville Series (811')			
Sandstone, massive, **Homewood?**	25	355	
Concealed	95	450	
Sandstone, shaly	20	470	
Concealed	15	485	
Shale, dark, with ferriferous limestone nodules and marine fossils	10	495	
Shale, dark, bony, with marine fossils, 0' 6", **Kanawha Black Flint horizon** (1085' B.)	0.5	495.5	170.5'
Slate, black, bony	0.5	496	
Shale, gray, (0' 8")	1	497	
Coal, (0' 4"), Stockton	...	497	
Fire clay shale	10	507	
Sandstone, massive, to creek	13	520	
Interval	200	720	
Continued by A. K. Wilson No. 2 (56 on Map II) Well Record (1010' B.):			
Conductor	16	736	
Sand	10	746	
Shale, black	49	795	
Sand, white	55	850	
Shale, black	110	960	
Sand, gray	17	977	
Shale, black	45	1022	526.5'
Oil sand, Salt of Rosedale	52	1074	
Shale, black	52	1126	
Oil sand and gas, Salt of Rosedale	15	1141	119'
Mauch Chunk Series (344')			
Shale, blue	8	1149	
Shale, red	256	1405	
Shale, blue	30	1435	
Lime rock	20	1455	
Sand, gray, and gas, Maxton	30	1485	344'
Greenbrier Limestone (230')			
"Trenton rock," Big Lime	230	1715	
Pocono Sandstones (181')			
Shale, blue	70	1785	
Sand, blue, **Big Injun**	25	1810	
Shale, blue	86	1896	
Catskill Series (594')			
Red rock	124	2020	
Sand, white	20	2040	
Shale, blue	155	2195	710'
Sand rock, oil sand, Gordon	45	2240	
Shale, blue	150	2390	195'
Sand, black, oil smell, Fifth	15	2405	

	Thickness. Feet.	Total. Feet.	
Shale, blue	25	2430	
Sand shale, blue, Bayard	60	2490	100′
Chemung Series (244′)			
Shale, blue, mixed, to bottom	244	2734	244′

Several sections were obtained in Salt Lick District on the waters of the Little Kanawha River above the mouth of Knawl Creek, the following having been measured with aneroid by Gawthrop eastward along the west hillside of the Little Kanawha to near the mouth of Big Run:

Section 1.6 Miles North of Napier, Salt Lick District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (185′)			
Sandstone, gray, coarse-grained, pebbly, making cliff, **Upper Sewickley**	30	30	
Concealed	70	100	
Bench	0	100	
Concealed	85	185	
Bench, **Pittsburgh Coal horizon** (1075′ B.)	0	185	185′
Conemaugh Series (300′)			
Concealed	165	350	
Sandstone	10	360	
Concealed	40	400	
Sandstone, **Morgantown**	25	425	
Concealed	6	431	
Shale, red	4	435	
Limestone or sandstone, impure, siliceous, **Orlando** (825′ B.)	2	437	252′
Sandstone	5	442	
Concealed to road forks (775′ B.)	43	485	48′

The following section, in the same district, was measured by the writer with aneroid northeastward mostly along the hill road from the summit of a high knob to the Little Kanawha River, one-fourth mile below Bulltown, nearly on the strike of the rocks:

Bulltown Section, Salt Lick District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (45′)			
Concealed from top of knob	45	45	45′
Conemaugh Series (500′)			
Sandstone, fine-grained, flaggy, forming steep cliff, **Lower Pittsburgh**	45	90	

	Thickness. Feet.	Total. Feet.	
Concealed, with shale to spring	10	100	
Concealed along bench	35	135	
Sandsone, massive, fine-grained to medium, green, **Connellsville**	40	175	130′
Concealed	25	200	
Shale, red	20	220	
Sandstone, green, micaceous	15	235	
Concealed to spring	55	290	
Concealed	4	294	
Limestone, brecciated, nodular, **Elk Lick**	1	295	120′
Concealed	5	300	
Sandstone, shaly, **Grafton**	10	310	
Concealed	25	335	
Sandstone and red shale	20	355	
Concealed	5	360	
Coal blossom, Harlem	0	360	65′
Shale	5	365	
Concealed	40	405	
Sandstone, **Saltsburg**	25	430	
Concealed and sandy shale	12	442	
Slate, dark-gray	2	444	
Coal, Bakerstown	1	445	85′
Fire clay shale	10	455	
Shale	10	465	
Sandstone, flaggy bottom, massive top, medium- to coarse-grained, blue-gray to brown, **Buffalo**	40	505	
Shale and concealed	5	510	
Slate, black	4	514	
Coal, visible, **Brush Creek**, (810′ B.)	1	515	70′
Fire clay shale	5	520	
Shale, limy, sandy	10	530	
Sandstone, **Upper Mahoning**	5	535	
Concealed to Little Kanawha River	10	545	30′

One mile and a half southeastward, the following succession is obtained by combining a section measured by the writer, at the falls of the Little Kanawha at Falls Mill, with the log of an old well (11 on Map II) drilled for salt water on the north bank of the river, immediately below the falls, Herman Johnson of this place being authority for the record of the boring. The exposure shows the Upper Kittanning Coal thinned below minable dimensions, although occurring in good thickness at country banks less than one-fourth mile below the cataract in question:

Falls Mill Section, Salt Lick District.

	Thickness.	Total.	
Allegheny Series (166')	Feet.	Feet.	
Sandstone, grayish-white, current-bedded, medium-grained, **Lower Freeport**	60	60	
Shale, gray	0.5	60.5	
Coal, slaty, Upper Kittanning "Rider" (830' B.)	0.3	60.8	60.8'
Shale, buff and brown, plant fossils abundant	5.2	66	
Sandstone	1	67	
Slate, black, cannelly at base	10	77	
Coal, (5" to 6"). **Upper Kittanning**	0.5	77.5	16.7'
Fire clay, plastic, **Upper Kittanning**	7.5	85	
Sandstone, massive, **Upper East Lynn?**	6	91	
Fire clay, flinty, **Upper Kittanning?**	1	92	
Shale, gray, argillaceous, with lenses (6" to 8" in diameter) of impure limestone (**Johnstown**) at top, to bed of Kanawha	5	97	
Continued with log Old Salt Well (11 on Map II) (800' B.):			
Sandstone, hard, **East Lynn**	60	157	
Coal, Lower Kittanning, with parting, reported by Herman Johnson	9	166	88.5'

Slightly less than 3 miles southeastward in the same district, the following section was determined with aneroid by the writer along the Little Kanawha at the mouth of England Run. The upper 365 feet was measured along the hill road at the head of the latter stream, and the basal portion, in the steep hills adjacent to its mouth:

Gregory Section, Salt Lick District.

	Thickness.	Total.	
Conemaugh Series (275')	Feet.	Feet.	
Sandstone, coarse, brown and pebbly	30	30	
Concealed	15	45	
Sandstone, coarse, brown, **Saltsburg**	20	65	65'
Concealed	135	200	
Sandstone	10	210	
Shale and concealed	45	255	
Sandstone, current-bedded, grayish-white, **Lower Mahoning**	20	275	210'
Allegheny Series (255')			
Concealed	10	285	
Sandstone, massive, very pebbly, current-bedded, **Upper Freeport**	50	335	
Concealed	30	365	
Sandstone, **Upper East Lynn**	100	465	
Concealed	65	530	255'

	Thickness. Feet.	Total. Feet.	
Pottsville Series—Kanawha Group (155')			
Sandstone, cliff rock 55'			
Concealed 10 } Homewood	120	650	
Sandstone, making great cliff 55			
Concealed	10	660	
Coal, Stockton, slaty	5	665	135'
Concealed to bed of river (845' B.)	20	685	20'

In the extreme southeast edge of Salt Lick District, the following section was measured with aneroid by Gawthrop southward along a ravine to the bed of the Little Kanawha, 100 yards below the forks of the latter at Wildcat P. O.:

Section Just North of Wildcat, Salt Lick District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (195')			
Concealed from L. E. Drummond Coal Prospect, Upper Kittanning?	25	25	25'
Sandstone, partly concealed, Upper East Lynn	65	90	
Sandstone, coarse-grained, brown, full of pebbles, East Lynn	35	125	
Concealed	31	156	
Coal prospect, concealed, (reported), Lower Kittanning (1290' B.)	4	160	135'
Concealed	35	195	
Pottsville Series—Kanawha Group (320')			
Sandstone, massive, medium-grained, grayish-brown, hard 25'			
Concealed 30 } Homewood	95	290	
Sandstone, massive, hard, medium-grained, brownish-gray, micaceous 40			
Shale, dark-gray, coal trace, Stockton "A"	2	292	
Concealed	8	300	
Sandstone, massive, brown, medium-grained, hard, micaceous	25	325	
Coal, (10"), Stockton (1125' B.)	1	326	166'
Shale, siliceous	1	327	
Concealed	18	345	
Sandstone, flaggy	10	355	
Concealed to bed of Little Kanawha River 100 yards below Wildcat	160	515	189'

The foregoing section differs very materially from that published on pages 73-4 of the Lewis-Gilmer Report, as determined by D. B. Reger, in that the base of the Allegheny Series is placed about 150 feet higher in the measures, which, if correct, would make the coal at 90 feet from the top of the

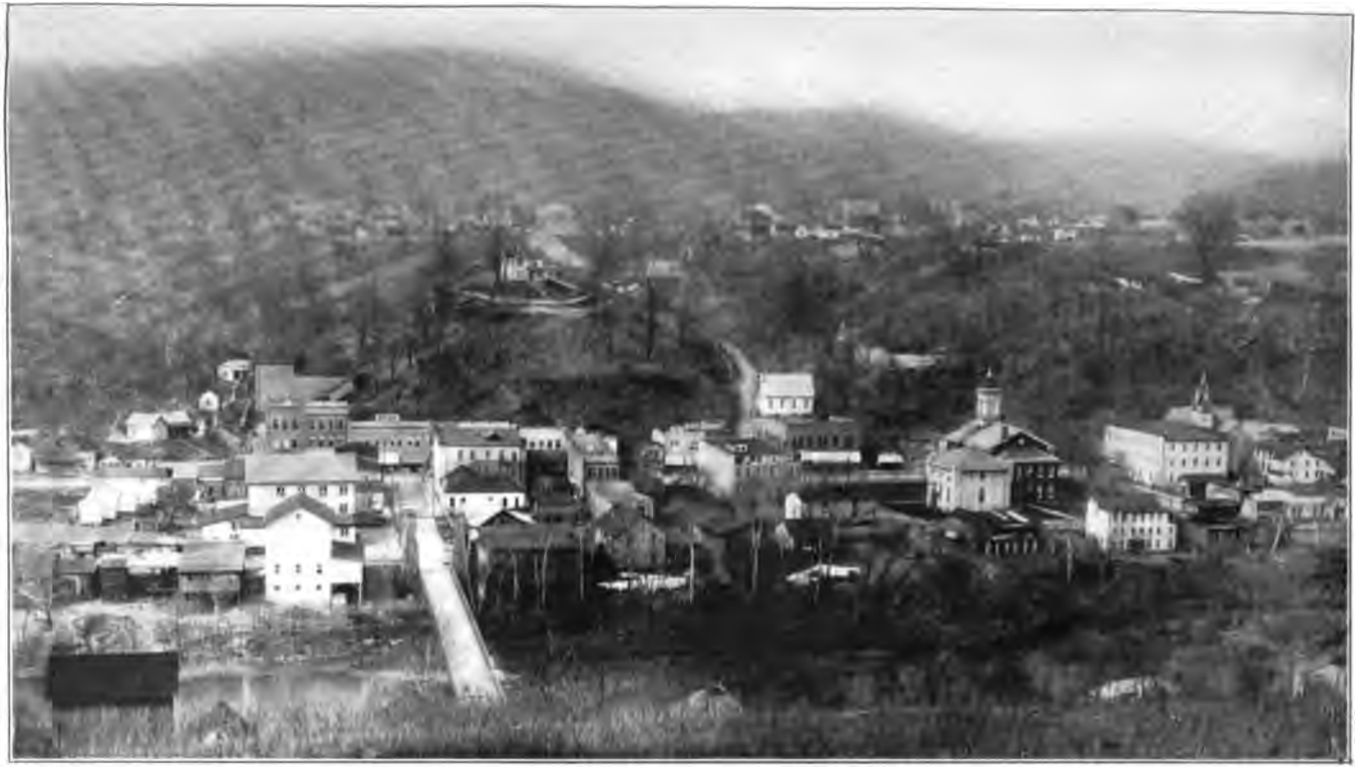

PLATE III.—Another view of Sutton looking north, showing the well-defined river terrace mentioned in Chapter II, and topography of Monongahela and Conemaugh Series.

section last mentioned correlate with the **Upper Kittanning** instead of the **Brush Creek**, and places practically the entire portion classified as Conemaugh Series in the Allegheny. The correlations as given above are further corroborated by the following section, measured with aneroid by the writer northeastward on the south hillside of Right Fork, just west of the mouth of Threelick Run:

Section 1 Mile Southeast of Wildcat, Salt Lick District.

	Thickness. Feet.	Total. Feet.
Allegheny Series (185')		
Sandstone, grayish-white, Lower Freeport..	30	30
Sandstone, making great cliff, grayish-white, coarse, pebbly, Upper East Lynn.......	55	85
Concealed, steep slope....................	30	115
Sandstone, massive cliff, East Lynn........	25	140
Concealed, steep slope....................	20	160
Concealed along bench....................	17	177
Shale, gray...............................	1.7	178.7
Coal, softer.......2' 2" Sandstone, hard...2 0 Coal, semi-splint...2 2 } Lower Kittanning. (1435' B.)	6.3	185
Slate		

The coal at the base of the above section is undoubtedly the Lower Kittanning and comes at an elevation of 1435′ B., 145 feet higher than in the preceding section, which is in harmony with the prevailing southeastward rise of the strata in this region.

The following section, with slight changes in the correlation of members in the upper 200 feet, published by D. B. Reger on pages 75-6 of the Lewis-Gilmer Report, is of special importance in connection with the stratigraphy of the Allegheny Series of Braxton and Clay, in that the three Kittanning Coals are all present, and their position shown with reference to the Kanawha Black Flint horizon. The exposure is within 3½ miles of Braxton-Lewis County Line and the measurements for the upper 775 feet were made with hand-level by Mr. Reger. The writer has placed the base of the Conemaugh Series 43 feet higher in the measures, since in the adjoining region of Braxton, 125 to 140 feet are the prevailing figures for the interval between the Upper Freeport and

Upper Kittanning Coals, and both the Upper Freeport and Lower Freeport Sandstones are present in good development, and the Upper Mahoning Sandstone, massive and very pebbly; hence, the correlations indicated:

Cleveland Section, Corner of Lewis, Upshur, and Webster Counties.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (100')			
Sandstone, massive, gray, pebbly, capping knob, **Upper Mahoning**	60	60	
Fire clay, **Thornton**, along bench	...	60	60'
Shale, gray and sandy	40	100	40'
Allegheny Series (260')			
Shale, gray, sandy, with plant fossils and iron ore, **Upper Freeport**	15	115	
Sandstone, shaly, **Upper Freeport**	28	143	
Concealed in bench	22	165	
Sandstone, partly concealed in bluff, **Lower Freeport**	35	200	
Concealed	15	215	
Shale, gray, sandy, with plant fossils	11	226	
Coal ....0' 4" Shale, dark....0 7 **Coal** ....2 8 } **Upper Kittanning** (3' 7") (1780' L.) (John Beverage Mine)	4	230	130'
Concealed	35	265	
Sandstone, massive, pebbly, cliff rock, **Upper East Lynn**	30	295	
Concealed	9	304	
Coal blossom, Middle Kittanning	1	305	75'
Concealed	12	317	
Sandstone, massive, cliff rock, with numerous plant fossils at base, **East Lynn**	35	352	
Coal ....3' 8" Slate, black...1 0 **Coal** ....0 11 Slate, black...0 1 Coal, visible..2 8 } **Lower Kittanning** (8' 4") (1665' B.) (Nimrod Lake Mine).	8	360	55'
Pottsville Series (845')			
Steep slope with massive sandstone, **Homewood**	90	450	90'
Coal opening, thickness concealed, not much found (**Stockton "A"**), (1590' L.)	...	535	
Concealed in steep slope	85	535	
Fire clay spring, **Kanawha Black Flint horizon?**	...	535	85'
Concealed in bench	10	545	
Concealed in slope	45	590	
Sandstone, massive, cliff rock, (**Upper Winifrede**)	50	640	
Concealed	90	730	
Sandstone, massive, partly concealed, to Little Kanawha River, **Cleveland**	45	775	

	Thickness. Feet.	Total. Feet.	
Interval	45	820	
Continued by Record of Vandervort and Pickens No. 1 Well, (1220' B.) (67 on Map II):			
Quicksand	25	845	
Sand, white, hard (conductor, 35'), Salt of Rosedale	25	870	
Lime and slate	75	945	
Sand, hard and poor	33	978	
Lime	25	1003	
Shale and lime	89	1092	
Lime, sandy	93	1185	
Shale, white	20	1205	670'
Mauch Chunk Series (575')			
Lime, sandy, shale and red rock	515	1720	
Sand, Maxton	25	1745	
Lime, sandy	25	1770	
Shale, black	10	1780	575'
Greenbrier Limestone (165')			
Big Lime	165	1945	165'
Pocono Sandstones (425')			
Sand (cave, 1200'; salt water, 1225') ....100' Sand and lime (cased, 6⅝") 40 } **Big Injun**	140	2085	
Red rock	20	2105	
Lime, sandy	215	2320	
Sand, gray, Berea	50	2370	425'
Catskill Series (257')			
Shells, sandy, and slate	50	2420	
Lime, shells, and slate	100	2520	
Lime, sandy	50	2570	
Lime, shells, and slate, to bottom	57	2627	257'

In the southwestern corner of Salt Lick District, the following section was measured with aneroid by Gawthrop eastward along the hill road 0.6 mile north of Berry Siding:

Section 0.6 Mile North of Berry Siding, Salt Lick District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (195')			
Concealed from top of knob	20	20	
Sandstone, massive, broken, brownish-gray, partly concealed, Upper Sewickley	35	55	
Concealed	35	90	
Concealed with sandstone	10	100	
Sandstane, flaggy, medium- to fine-grained, grayish-brown	20	120	
Concealed	75	195	195'
Conemaugh Series (380')			
Shale, red	3	198	
Sandstone	2	200	

	Thickness. Feet.	Total. Feet.	
Shale, greenish-gray	5	205	
Sandstone, flaggy, greenish-gray, fine-grained, micaceous	15	220	
Shale, gray, siliceous, sandstone layers	30	250	
Concealed with red shale	30	280	
Concealed to bench	30	310	
Concealed to bench	15	325	
Shale, red	15	340	
Sandstone, massive	10	350	
Shale, red, partly concealed	70	420	
Concealed and red shale	80	500	
Sandstone, massive	14	514	
Shale, red	5	519	
Limestone, nodular, gray, hard, **Ewing** (945' B.)	1	520	325'
Shale, red and grayish-red	30	550	
Concealed	20	570	
Concealed from railroad track to Right Fork of O'Brien Creek (890' B.)	5	575	55'

Otter District (Braxton) Sections.

On the waters of Cedar Creek in the northeast edge of Otter District, the following section was measured with aneroid by Gawthrop southeastward along a hill road to Brush Run:

Section One Mile Northwest of Braxton, Otter District.

Monongahela Series (200')	Thickness Feet.	Total. Feet.	
Concealed with shale and thin layers of sandstone	60	60	
Sandstone, massive, visible	5	65	
Concealed with red shales	5	70	70'
Limestone, nodular, ferriferous, **Sewickley** (1170' B.)	1.5	71.5	
Shale, red	5.5	77	
Shale, gray, siliceous	3	80	
Shale, red	5	85	
Concealed to bench	10	95	
Sandstone, massive, fine-grained, greenish-gray, micaceous	10	105	
Concealed	5	110	
Shale, red, gray, and red	30	140	
Sandstone	5	145	
Concealed	5	150	
Shale, gray	20	170	
Sandstone, massive	15	185	
Shale, gray, siliceous	14	199	
Coal, in road (11"), **Pittsburgh** (1040' B.)	1	200	130'

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (110')			
Fire clay shale	2	202	
Concealed	8	210	
Sandstone	5	215	
Concealed, with gray shale	20	235	
Sandstone, massive	10	245	
Concealed	15	260	
Sandstone, massive, coarse-grained, partly concealed at base, **Connellsville**	35	295	
Concealed to Brush Run (945' B.)	15	310	110'

Slightly less than a mile northeastward, the following section, extending 225 feet higher in the measures, was measured with aneroid by Gawthrop from the summit of a high knob, on the Salt Lick-Otter District Line, southward to the head of Brush Run:

Section One Mile North of Braxton, Otter District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (425')			
Concealed from top of knob	5	5	
Sandstone, flaggy	5	10	
Concealed	35	45	
Sandstone, flaggy, partly concealed	25	70	
Sandstone, massive, coarse-grained, brown, micaceous, **Uniontown**	30	100	100'
Concealed in steep slope	20	120	
Concealed, mostly red shale, to bench	100	220	
Shale, red	5	225	
Concealed, mostly	10	235	
Sandstone, massive, coarse-grained, gray	10	245	
Concealed	35	280	
Shale, red	5	285	
Concealed	55	340	
Sandstone	5	345	
Concealed	35	380	
Sandstone, shaly	10	390	
Concealed	15	405	
Sandstone, massive	10	415	
Concealed	9.3	424.3	
Coal, in head of Brush Run, **Pittsburgh**, (8") (1030' B.)	0.7	425	325'

Three to four miles southeastward in the same district, the following section was measured with aneroid by Gawthrop from the summit of a knob eastward on the west hillside of Shaver Fork, 0.4 mile below Lloydsville:

Section 0.4 Mile Northwest of Lloydsville, Otter District.

	Thickness. Feet.	Total. Feet.
Monongahela Series (345')		
Concealed from top of knob	75	75
Bench	0	75
Concealed with shale	50	125
Bench	0	125
Concealed in steep slope	90	215
Bench and concealed	130	345
Coal, (reported), Pittsburgh (1150' B.)	0	345
Conemaugh Series (135')		
Concealed	75	420
Bench	0	420
Concealed	50	470
Sandstone, Connellsville (1015' B.)	10	480

In the eastern edge of Otter District, Gawthrop measured the following section with aneroid down the east hillside of Westfall Fork of Cedar Creek:

Section 0.2 Mile North of Fairbanks, Otter District.

		Thickness. Feet.	Total. Feet.	
Monongahela Series (200')				
Sandstone, massive, brown, coarse-grained, full of pebbles 40' Concealed 5 Sandstone, massive, flaggy 20	Upper Sewickley	65	65	65'
Concealed		50	115	
Sandstone, massive		5	120	
Concealed to bench		80	200	
Bench, Pittsburgh Coal horizon (1310' B.)		0	200	135'
Conemaugh Series (160')				
Concealed to bench		90	290	
Concealed and unrecorded to bed of Shaver Fork		70	360	160'

In the same district, the following section was measured with aneroid by Gawthrop on Left Fork of Steer Creek, opposite the mouth of Wyatt Run:

Section One Mile Southeast of German, Otter District.

Conemaugh Series (160')		Thickness. Feet.	Total. Feet.
Bench, Pittsburgh (1050' B.)		0	0
Concealed		15	15
Sandstone, coarse-grained, brownish-gray ....20'	Lower Pittsburgh (975' B.)	60	75
Concealed 10			
Sandstone, massive, coarse-grained, brown, pebbly (975' B.)................30			
Concealed		30	105
Shale, gray and red		25	130
Sandstone, massive, greenish-gray, fine-grained, Connellsville, (910' B.)		10	140
Concealed, mostly red shale to road forks		20	160

The foregoing section is important, in that the base of the Lower Pittsburgh Sandstone is shown to extend to 75 feet below the Pittsburgh Coal horizon, this ledge being a prominent cliff-former in western Braxton and northern Clay, always pebbly, and frequently mistaken for the Connellsville stratum, the base of the latter belonging 140 to 150 feet below the Pittsburgh Coal. The following section, measured with aneroid by the writer on O'Brien Fork in the northeast edge of Otter District eastward along the hill road, further corroborates the correlation of the Lower Pittsburgh Sandstone and shows the stratigraphic position of the great conglomeratic Sewickley ledge, the top of the latter ranging from 175 to 200 feet above the base of the Pittsburgh Coal in the area under discussion:

Mark Section, Otter District.

Monongahela Series (210')	Thickness. Feet.	Total. Feet.	
Concealed and shale	20	20	
Fire clay and shale	10	30	
Sandstone, flaggy, and shale	5	35	35'
Sandstone, coarse, brown, pebbly, Upper Sewickley	65	100	
Shale, brown, sandy	20	120	
Sandstone, coarse, brown, friable	25	145	
Shale, sandy, brown	15	160	
Sandstone, platy, Weston	35	195	
Concealed	5	200	
Spring, Pittsburgh Coal horizon (990' B.)	10	210	175'

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (125′)			
Shale, sandy	35	245	
Sandstone, top platy, lower half conglomeratic, **Lower Pittsburgh**	50	295	85′
Concealed	40	335	40′

In the same District, the following section was measured with aneroid by the writer, about 2 miles northwest of Gassaway, from a hill summit just east of Sugar Knob, southeastward mostly along the hill road on the head of Rush Run, nearly on the strike of the strata, the dip of the latter in the same direction probably not being over 20 feet, thus making the Pittsburgh Coal-Ames Shale interval about 360 feet. This is the farthest point southwest of the Little Kanawha Valley in either county that marine fossils were observed at the latter horizon, and here they were very small and not well preserved:

Sugar Knob Section, Otter District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (250′)			
Sandstone, coarse, brown, massive, from top of hill	40	40	
Concealed in long bench	10	50	50′
Snadstone, coarse, brown, massive, pebbly, makes great cliff, **Upper Sewickley**	50	100	
Concealed, steep slope, mostly sandstone	45	145	
Bench, flat	5	150	
Concealed in steep slope, with sandstone	85	235	
Concealed	10	245	
Coal digging, Pittsburgh (No. 169 on Map II), thickness concealed	5	250	200′
Conemaugh Series (380′)			
Concealed and sandstone	125	375	
Concealed and red shale	160	535	
Sandstone, shaly	15	550	
Shale, red	25	575	
Sandstone, massive, coarse, brown, **Grafton**	43	618	
Shale, green, **very small marine fossils, Ames** (990′ B.)	2	620	370′
Concealed to bed of Rush Run	10	630	10′

In the west edge of Otter District, the following section was measured with aneroid by Gawthrop northward along the west hillside of Sugarcamp Run to an exposure of the Sutton Limestone in the public highway, 0.9 mile south of Clickton, the latter stratum having been carefully traced by Mr. Gawthrop from Gassaway to this locality. The Pittsburgh Coal belongs about 300 feet above the top of the section. Owing to the dip of the rocks in a direction opposite to that in which the measurements were determined, the results are slighty less than they should be:

Section 2 Miles West of Gassaway, Otter District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (267')			
Sandstone, massive, brownish-gray, medium-grained, **Morgantown**	9	9	
Coal prospect, closed, reported (1' 3"), Elk Lick	1	10	10'
Concealed	10	20	
Limestone, not visible, reported, **Elk Lick**	2	22	
Concealed	18	40	
Concealed, with red shale	35	75	
Concealed, with sandstone	59	134	
Shale, dark-gray	6	140	
Coal, (reported), thickness concealed, 0' 6", Bakerstown	0	140	130'
Fire clay shale	1	141	
Concealed	5	146	
Sandstone, massive, gray	9	155	
Concealed, with gray shale	25	180	
Shale, siliceous, gray	45	225	
Coal, slaty ......1' 0" **Coal**, concealed, (reported) ....1 0 } **Brush Creek** (970' B.)	2	227	87'
Shale and concealed	10	237	
Sandstone, massive, coarse-grained, hard, micaceous, **Upper Mahoning**	26	263	
Shale, siliceous	2	265	
Limestone, hard, nodular, brownish-gray, in bed of run, Sutton, (928' L.)	2	267	40'

The following section was measured with aneroid by Gawthrop—the writer supplying the Brush Creek Coal at base—from the summit of a high knob southeastward on the northwest hillside of Elk, on the strike of the strata, to the bed of the River opposite the Coal and Coke Railway shops at Gassaway:

Section in Northwest Edge of Gassaway, Otter District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (275')			
Concealed from top of knob	50	50	
Concealed to bench	10	60	60'
Sandstone, massive, coarse-grained, brownish-gray, **Upper Sewickley**	20	80	
Concealed	85	165	
Sandstone	5	170	
Concealed	20	190	
Sandstone, fine-grained, massive base, flaggy top, micaceous, **Weston**	20	210	
Concealed, mostly shale	25	235	
Concealed to bench, **Pittsburgh Coal horizon**, (1365' B.)	40	275	215'
Conemaugh Series (545')			
Sandstone, massive, brown, medium-grained, micaceous, partly concealed, **Lower Pittsburgh**	70	345	
Concealed to bench	60	405	
Sandstone	5	410	
Concealed	100	510	
Concealed, holding **Morgantown Sandstone**	55	565	290'
Concealed to bench	85	650	
Sandstone, shaly 10' Sandstone, massive, fine-grained, brown, micaceous 25 } **Saltsburg**.	35	685	
Shale, grayish-brown, siliceous	10	695	
Sandstone, shaly	5	700	
Concealed	30	730	
Sandstone, massive, hard, fine-grained, micaceous	5	735	
Concealed	10	745	
Shale, brownish-gray, siliceous	5	750	
Concealed	5	755	
Sandstone, massive, medium-grained, whitish-gray, micaceous, medium-hard, **Buffalo**	20	775	
Concealed and shale, with **marine fossils, Brush Creek**	14	789	
Coal, Brush Creek, 6" to	1	790	225'
Shale and concealed to Elk River	30	820	30'

The following section was measured with aneroid by Gawthrop northeastward along the hill road on the head of Bear Run. The intervals are slightly more than they should be, owing to the dip of the strata in this direction:

Section 2¼ Miles South of Gassaway, Otter District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (370')			
Concealed from road summit, low gap......	75	75	
Snadstone, massive, medium-grained, brownish-gray, **Morgantown**..................	20	95	
Concealed	35	130	
Shale, greenish-gray........................	5	135	135'
Limestone, gray, hard....0' 6" } **Elk Lick**..	6	141	
Shale ....5 0 } (1215' B.)			
Limestone ....0 6 }			
Shale, reddish-brown........................	19	160	
Concealed	15	175	
Sandstone, shaly, **Grafton**..................	35	210	75'
Concealed	150	360	
Sandstone, coarse-grained (985' B.).........	10	370	160'

In the extreme east edge of Otter District, the following section was measured with aneroid by Gawthrop from the summit of a high knob, 0.5 mile northwest of the mouth of Brush Fork of Granny Creek, southward mostly along the hill road to the bed of the latter stream, almost along the strike of the strata:

Section 1 Mile North of Sutton, Otter District.

	Thickness. Feet	Total. Feet.	
Monongahela Series (235')			
Concealed and red shale from top of knob...	30	30	
Shale, gray..............................	5	35	35'
Sandstone, massive, coarse-grained, to bench.......10' } **Upper**			
Concealed .... 5 } **Sewickley**	50	85	
Sandstone, massive.........10 }			
Concealed ....15 }			
Sandstone, shaly............10 }			
Concealed	40	125	
Shale, gray, siliceous......................	10	135	
Sandstone, massive, fine-grained, greenish-gray, micaceous......................	15	150	
Concealed, mostly sandstone..............	5	155	
Sandstone, massive......................	10	165	
Concealed, with sandstone in steep slope...	55	220	
Concealed, with shale, to **Pittsburgh** bench (1370' B.)...........................	15	235	200'
Conemaugh Series (515')			
Sandstone, massive, broken, **Lower Pittsburgh**	15	250	
Concealed, with shale......................	15	265	
Sandstone, shaly.........................	10	275	
Sandstone, massive, partly concealed.......	15	290	

	Thickness. Feet.	Total. Feet.	
Concealed	20	310	
Shale, red, in bench	10	320	
Shale, red and gray, concealed to bench, **Connellsville**	55	375	140'
Shale, red, partly concealed	35	410	
Sandstone, flaggy, greenish-gray	15	425	
Concealed	5	430	
Sandstone, massive, broken, partly concealed, **Lower Connellsville**	30	460	85'
Concealed, with shale and sandstone	72	532	
Shale, red	4.5	536.5	
Limestone, gray 0' 6"			
Shale, red 2 0 — **Elk Lick** (1040' B.)	3.5	540	80'
Limestone, gray 1 0			
Shale, red, gray, and red	25	565	
Sandstone, shaly	5	570	
Shale, gray, siliceous	4	574	
Concealed	5	579	
Shale, red	10	589	
Limestone, gray, nodular, 2' to 1', **Ewing**, (990' B.)	1	590	50'
Shale, red and gray, partly concealed	25	615	
Shale, red	10	625	
Shale, gray and red, partly concealed	25	650	
Fire clay, gray, plastic	2	652	
Concealed, mostly red shale	8	660	
Concealed in bench	10	670	
Sandstone	5	675	
Concealed	30	705	
Sandstone	5	710	
Concealed to Granny Creek (830' B)	40	750	160'

One mile northwestward in the same District, the following section was measured with aneroid by Gawthrop down the hill road on the head of Perkins Fork. The results are greater than they should be owing to the dip of the rocks to the northwest:

Section 3 Miles North of Sutton, Otter District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (445')			
Concealed, with sandstone, from top of knob	35	35	
Sandstone, massive, coarse-grained, brown, pebbly cliff, **Uniontown** (1600' B.)	40	75	75'
Concealed	40	115	
Shale, red, partly concealed	40	155	
Sandstone, massive, coarse-grained, grayish-brown, **Upper Sewickley**	25	180	105'
Concealed	5	185	
Shale, red and gray	20	205	

	Thickness. Feet.	Total. Feet.	
Limestone, gray, nodular, 6″ to 1′ (1475′ B.)	1	206	
Concealed	59	265	
Sandstone, partly concealed, Lower Sewickley	40	305	
Shale, gray	5	310	
Limestone, gray (6″), Sewickley (1370′ B.)	0	310	
Shale, red	5	315	
Concealed	30	345	
Sandstone, shaly............10′ Sandstone, massive.......... 5 Sandstone, shaly, partly concealed ....40 Cedarville	55	400	
Concealed	10	410	
Sandstone, massive, gray, medium-grained, Weston	20	430	
Shale	1	431	
Limestone, gray, hard, 6″ to 1′, Redstone (1250′ B.)	1	432	
Concealed in slight bench, Pittsburgh	13	445	265′
Conemaugh Series (145′)			
Concealed	70	515	
Sandstone, gray and hard, massive, medium-grained, Lower Pittsburgh	25	540	
Concealed, with red shale, to Perkins Fork, (1090′ B.)	50	590	145′

The following section was measured with aneroid by Gawthrop northwestward from the summit of a high knob mostly along the hill road to the mouth of Cutlips Fork of Little Otter. The results are slightly greater than they should be due to the dip of the rocks in the same direction:

Section 1 Mile Northwest of Sutton, Otter District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (45′)			
Concealed from summit of hill	45	45	
Bench, Pittsburgh Coal horizon, (1370′ B.)	0	45	45′
Conemaugh Series (483′)			
Concealed in steep slope	30	75	
Sandstone, partly concealed	10	85	
Concealed	40	125	
Concealed to bench	15	140	
Shale, red, partly concealed	75	215	
Sandstone, shaly, partly concealed ....15′ Sandstone, massive, medium-grained, greenish-gray, hard...........12 Sandstone, massive, soft, coarse-grained, few pebbles .... 3 Lower Connellsville.	30	245	200

	Thickness. Feet.	Total. Feet.	
Shale, greenish-gray, and red	5	250	
Concealed, mostly shale	15	265	
Shale, red	15	280	
Shale, greenish-gray	5	285	
Sandstone, shaly	10	295	
Shale, red	22	317	
Fire clay shale, gray, plastic	3	320	
Sandstone, massive, coarse-grained, pebbly, soft at base, hard at top, **Grafton**	55	375	130'
Sandstone, shaly	5	380	
Shale, gray and red	10	390	
Shale, gray, siliceous	5	395	
Shale, red	3	398	
Fire clay (0' 2")	0	398	
Shale, green	2	400	
Shale, red, limestone nodules	5	405	
Coal trace, slaty, fire clay, **Harlem** (1") (1000' B.)	0	405	30'
Fire clay and gray shale	5	410	
Sandstone, massive, shaly layers	15	425	
Shale, gray	5	430	
Shale, gray, limestone nodules	7	437	
Limestone, gray, nodular, **Ewing** (965' B.)	2	439	
Shale, red	3	442	
Sandstone, shaly, brown	10	452	
Shale, red and green	8	460	
Sandstone, massive, greenish-gray, fine-grained, hard, **Saltsburg**	10	470	
Sandstone, shaly	5	475	
Shale, red	10	485	
Concealed to Cutlips Fork (877' L.)	43	528	123

The following section, starting about 100 feet below the Pittsburgh Coal horizon, was measured with aneroid by the writer southeastward from the road summit along the hill road to the mouth of Granny Creek at Sutton. Owing to the rise of the rocks in this direction, the results are slightly less than they should be:

Section ½ Mile Northwest of Sutton, Otter District.

	Thickness. Feet.	Total. Feet.
Conemaugh Series (455')		
Shale, red, from road summit, low gap (1263' L.)	60	60
Sandstone, shaly	10	70
Concealed	20	90
Shale, red	15	105
Concealed	5	110
Sandstone	5	115
Shale, red and gray, siliceous	15	130

	Thickness. Feet.	Total. Feet.	
Sandstone, massive, shaly, coarse-grained, soft, pebbly, **Grafton**	40	170	170'
Sandstone, shaly	10	180	
Shale, red and gray	25	205	
Fire clay, dark, coal trace (3"), **Harlem** (1055' B.)	...	205	35'
Shale, gray	5	210	
Sandstone	5	215	
Shale, red	5	220	
Limestone, nodular, ferriferous	1	221	
Shale, red	4	225	
Limestone, nodular, gray, **Ewing** (1030' B.)	2	227	22'
Shale, red	28	255	
Sandstone, massive	5	260	
Shale, red	10	270	
Concealed	25	295	
Sandstone, massive, broken, shaly layers, **Saltsburg**	15	310	
Shale, partly concealed	25	335	
Sandstone, massive, gray, medium-grained, micaceous, pebbly, **Buffalo**	25	360	
Concealed in bench	10	370	
Sandstone, massive, medium-grained, pebbly, partly concealed, **Upper Mahoning**	30	400	
Fire clay shale	2	402	
Sandstone, shaly, with hard massive layers.	13	415	188'
Concealed, holding **Sutton Limestone**	15	430	
Concealed to Granny Creek (805' B.)	25	455	40'

On the south side of Elk in the same District, the following section was measured northeastward along the hill road to the River at Sutton:

Section Southwest Edge of Sutton, Otter District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (490')			
Concealed and sandstone from road summit	30	30	
Shale, purplish-red, limy top	20	50	
Shale, red and green	5	55	
Sandstone, green, medium-grained	10	65	
Shale, red	10	75	
Sandstone, coarse, greenish-gray, massive at top	55	130	
Concealed	20	150	
Sandstone, large quartz pebbles abundant, **Morgantown**	15	165	165'
Concealed	30	195	
Shale, red	10	205	
Concealed and shale, red	35	240	
Shale, green	10	250	
Concealed	5	255	

	Thickness. Feet.	Total. Feet.	
Shale, dark-red, **Pittsburgh**	10	265	100'
Concealed	25	290	
Sandstone	10	300	
Concealed	40	340	
Sandstone, massive, coarse-grained, pebbly	35	375	
Fire clay shale, dark at top	15	390	
Shale	5	395	
Concealed	5	400	
Fire clay shale	10	410	
Sandstone, massive	5	415	
Shale, sandy	24	439	
Limestone, yellowish, **Sutton** (870' B.)	1	440	175'
Concealed	5	445	
Shale, sandy	7	452	
Fire clay shale (855' B.)	3	455	
Concealed to Elk River	35	490	50'

In the same region, the following section was measured with aneroid by Gawthrop northwestward along the road and Otter-Holly District Line to Elk River at the bridge over the latter at Sutton, the top of which is 1¼ miles southeast of the base. Since there is a total dip between the two extremes of about 100 feet, the results are much greater than they should be. It contains much of interest, however, as practically the entire section is exposed:

Section in Southeast Edge of Sutton, Otter District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (545')			
Concealed and red shale from road summit	10	10	
Shale, greenish-gray	5	15	
Sandstone, shaly	10	25	
Sandstone, massive	10	35	
Shale, red, partly concealed	30	65	
Limestone, hard, gray, **Elk Lick** (1300' P.)	1	66	66
Shale, limy	1	67	
Sandstone	18	85	
Shale, red	5	90	
Shale, gray, siliceous	20	110	
Sandstone	10	120	
Shale, reddish-brown	25	145	
Sandstone and gray shale	10	155	
Shale, red	5	160	
Limestone (6"), **Ewing**	...	160	94'
Shale, greenish-gray	5	165	
Sandstone	10	175	
Shale, gray	5	180	
Shale, red, **Pittsburgh**	15	195	
Concealed, mostly gray shale	40	235	

	Thickness. Feet.	Total. Feet.	
Concealed, with sandstone	20	255	
Sandstone, massive, brownish-gray, soft, pebbly at base, partly concealed, **Saltsburg**	45	300	140'
Concealed, with sandstone	10	310	
Concealed	30	340	
Shale and fire clay	5	345	
Sandstone	5	350	
Fire clay shale	5	355	
Shale, siliceous	10	365	
Sandstone, massive, coarse-grained, micaceous, **Buffalo**	45	410	
Fire clay, coal trace	1	411	
Shale, siliceous	4	415	
Coal (9"), Brush Creek (950' B.)	1	416	116'
Shale	2	418	
Concealed	7	425	
Sandstone, shaly	10	435	
Fire clay shale	5	440	
Concealed	5	445	
Sandstone, shaly	40	485	
Limestone, gritty, **Sutton**	1	486	70'
Sandstone, shaly	4	490	
Concealed, with sandstone, to Coal and Coke Railway Station at Sutton (842' L.)	30	520	
Concealed to Elk River	25	545	59'

In the extreme southwest edge of Otter District, the following section was measured with aneroid by the writer northeastward along the private road leading to the mouth of Polemic Run of Little Birch River, almost along the strike of the rocks:

Mouth of Polemic Run Section, Otter District.

Conemaugh Series (245')	Thickness. Feet.	Total. Feet.	
Concealed and red shale from residence of Frank Davis	15	15	
Sandstone	10	25	
Concealed, mostly red shale	35	60	
Red shale and concealed	10	70	
Sandstone, green	25	95	
Concealed	5	100	
Fire clay shale and shale, sandy	25	125	125'
Sandstone, pebbly, **Upper Mahoning**	25	150	
Concealed and fire clay	20	170	
Concealed	15	185	
Shale, green	10	195	
Sandstone, flaggy, micaceous, greenish-gray ....25' Sandstone, grayish-white and brown, micaceous.......15 } **Lower Mahoning.**	40	235	

	Thickness. Feet.	Total. Feet.	
Concealed	10	245	120'
Allegheny Series (295')			
Concealed in steep bluff, mostly sandstone........40' Sandstone, massive, conglomeratic, large quartz pebbles....20 — **Upper Freeport..**	60	305	
Concealed in steep slope	50	355	
Concealed and sandstone	25	380	
Shale, dark, sandy	3.5	383.5	
Coal, medium-soft, bright, Upper Kittanning, at Frank Davis Opening (No. 415 on Map II) (1215' B.)	1.5	385	140'
Shale	5	390	
Sandstone, grayish-white, **Upper East Lynn,** and concealed in steep slope	60	450	
Concealed in slight bench, **Middle Kittanning Coal horizon**	10	460	
Sandstone, grayish-white, **East Lynn**	40	500	
Concealed	40	540	155'
Pottsville Series (60')			
Sandstone, grayish-white, makes cliff, **Homewood**	45	585	
Concealed to Little Birch River, mouth of Polemic Run (1010' B.)	15	600	60'

The following section was measured with aneroid by the writer in the extreme southeastern border of Otter District, Braxton County, southeastward down the west hillside of Laurel Run of Little Birch to the mouth of Gravel Fork. The results are slightly less than they should be, owing to the rise of the strata in the same direction:

Gravel Fork of Laurel Run Section, Otter District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (220')			
Bench and shale	5	5	
Sandstone, conglomeratic, large quartz pebbles, **Upper Freeport**	50	55	
Concealed and shale	80	135	
Sandstone, grayish-white, current-bedded, **Upper East Lynn**	50	185	
Concealed, steep slope	25	210	
Concealed, bench	8	218	
Coal, Lower Kittanning? (No. 609 on Map II)	2	220	220'
Pottsville Series—Kanawha Group (90')			
Sandstone, grayish-white, **Homewood**	75	295	
Concealed	15	310	90

Two miles due southward in the edge of Nicholas County, the writer measured with aneroid the following section, including the whole of the Allegheny Series, northeastward to an opening in the Clarion Coal near schoolhouse and on the north bank of branch of Mill Creek:

Mill Creek Section, Nicholas County.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (320')			
Sandstone, coarse, brown, pebbly at base, **Upper Freeport**	65	65	
Concealed, bench, **Lower Freeport Coal horizon**	15	80	
Sandstone, coarse, brown, conglomeratic, with large quartz pebbles, **Lower Freeport**	60	140	
Concealed, steep slope	30	170	
Concealed, bench, **Middle Kittanning Coal horizon**	25	195	195'
Sandstone, grayish-white, pebbly in basal 10', makes cliff, **East Lynn**	45	240	
Concealed	20	260	
Bench, **Lower Kittanning Coal horizon**	10	270	75
Concealed and sandstone, grayish-white, **Kittanning**	47	317	
Shale	0.5	317.5	
Coal, Clarion (1560' B.)	2.5	320	50'

Birch District (Braxton County) Sections.

Birch District occupies the southwest border of Braxton County. The surface rocks in that portion northwest of Elk River are mostly in the Dunkard, Monongahela, and Conemaugh Series. The following section was determined by D. B. Reger, supplemented with the log of the J. W. Twyman No. 1 Well (84 on Map II) and published on pages 99-100 of the Lewis-Gilmer Report of the State Geological Survey. That portion above the well mouth was measured with hand-level by Reger on the northeast hillside at Rosedale, along the Gilmer-Braxton County Line, the section as a whole being of special interest in connection with the stratigraphy of the territory of this Report:

Rosedale Section, Birch District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (380')			
Shale, red and sandy, from top of knob	50	50	
Concealed in bluff	34	84	
Sandstone, massive, brown, coarse, **Gilboy**	16	100	
Concealed in bench	12	112	
Sandstone, partly concealed in bluff, **Uniontown**	28	140	140
Shale, red, partly concealed	35	175	
Sandstone, partly concealed, **Arnoldsburg**	17	192	
Spring, Lower Uniontown Coal horizon	...	192	
Concealed in slope	26	218	
Sandstone, massive, gray, pebbly, great cliff rock, **Upper Sewickley**	57	275	135'
Shale, sandy	26	301	
Sandstone, flaggy and shaly, **Cedarville**	12	313	
Concealed and sandy shale	12	325	
Sandstone, shaly, **Weston**	40	365	
Shale, variegated, and sandy	15	380	
Fire clay streak, **Pittsburgh Coal horizon** (935' L.) (reported 0' 8" thick on opposite hill	...	380	105'
Conemaugh Series (654')			
Shale, variegated	12	392	
Sandstone, massive, gray, coarse 28' Shale, variegated and sandy 22 Sandstone, greenish-gray, shaly 16 **Lower Pittsburgh**	66	458	
Red shale, partly concealed	22	480	
Sandstone, shaly, **Connellsville**	20	500	
Concealed, mostly red shale, to well mouth.	19	519	
Continued by J. W. Twyman No. 1 (84 on Map II) Well Record (796' L.):			
Clay and gravel	30	549	
Lime (13" casing, 40' 3"; water, 45')	15	564	
Red rock and lime shells	115	679	
Slate	20	699	
Red rock (10" casing, 184')	12	711	
Sandstone, soft, (water, 195'), Grafton	18	729	
Red rock 50' Slate 15 Red rock 10 **Pittsburgh Reds**	75	804	
Slate, white	45	849	
Coal, Bakerstown	5	854	474'
Slate	5	859	
Sand, **Buffalo**	35	894	
White slate and lime	75	969	
Sand, Upper Mahoning	65	1034	180'
Allegheny Series (250')			
Coal, Upper Freeport (water 520'=1039' of section)	5	1039	
Slate	25	1064	
Sand, Upper Freeport	29	1093	

	Thickness. Feet.	Total. Feet.	
Slate	51	1144	
Coal, Upper Kittanning	2	1146	112'
Slate and shells (8¼" casing, 663')	40	1186	
Sand, East Lynn	57	1243	
Slate	12	1255	
Sand, Kittanning	29	1284	138'
Pottsville Series (782')			
Slate and shells	409	1693	
Sand, Salt, (oil show, 1200'; gas, 1240')	101	1794	
Slate and shells	99	1893	
Sand, Salt (gas, 1406'; oil, 1434')	70	1963	
Slate and shells (6⅝" casing, 1464')	41	2004	
Sand, Salt (gas, 1495')	15	2019	
Slate and shells	25	2044	
Sand, Salt	22	2066	782'
Mauch Chunk Series (72')			
Slate and shells	18	2084	
Red rock	15	2099	
Slate and shells to bottom	39	2138	72'

Four miles southeastward in the same District, the following succession is obtained by combining a section measured with aneroid by Gawthrop down the east hillside of Right Fork of Steer Creek, with a log of the Baldwin Heirs No. 3 Well (102 on Map II), drilled by J. S. Carr et al., the record of which was furnished by G. L. McKain of Parkersburg, West Virginia:

Section 1¾ Miles Northeast of Sleith, Birch District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (180')			
Concealed and sandstone, massive, coarse-grained, pebbly in lower 30', brown, **Upper Sewickley**	50	50	
Concealed	25	75	
Sandstone, flaggy, partly concealed, **Cedarville**	30	105	
Concealed	75	180	180'
Conemaugh Series (637')			
Concealed	35	215	
Sandstone, partly concealed.25' Sandstone, massive, coarse-grained, pebbly..........15 } **Lower Pittsburgh**	40	255	
Concealed	15	270	
Sandstone	5	275	
Concealed	40	315	
Sandstone, partly concealed, **Connellsville**	20	335	155'

	Thickness. Feet.	Total. Feet.	
Continued with Log of Baldwin Heirs No. 3 (102 on Map II) Well (860′ B.):			
Clay	10	345	
Gravel	10	355	
Sand, (**Connellsville**)	14	369	34′
Slate	17	386	
Sand, (**Lower Connellsville**)	20	406	
Red rock 23′ Blue lime 18 Red rock 6 } **Clarksburg Reds**	47	453	
Sand, Morgantown	23	476	107′
White slate	14	490	
Red rock	20	510	
Lime	16	526	
Red rock	6	532	
White slate	11	543	
Limestone	19	562	
Red rock, **Pittsburgh**	13	575	
White slate	20	595	
Red rock and shells	90	685	
Limestone	20	705	229′
Sand (some oil), Upper Mahoning	27	732	
White slate	33	765	
Red rock	20	785	
Lime	20	805	
Sand (some oil), ("Big Dunkard") Lower Mahoning	12	817	112′
Allegheny Series (260′)			
Lime	18	835	
Sand, **Upper Freeport**	80	915	
Black slate, **Lower Freeport Coal horizon**	6	921	
Lime	39	960	
Coal, Upper Kittanning	6	966	149′
Lime	19	985	
Fire clay	12	997	
Lime	18	1015	
Coal, Middle Kittanning	2	1017	51′
Lime	9	1026	
Shale	19	1045	
Coal, Lower Kittanning	2	1047	30′
Shale	20	1067	
Lime	10	1077	30′
Pottsville Series (950′)			
Sand, (**Homewood**)	98	1175	
Black slate and shells	35	1210	
Coal, (Stockton?)	2	1212	135′
Black slate	63	1275	
Lime	30	1305	
Sand, **Lower Coalburg?**	30	1335	
White slate	6	1341	
Lime	9	1350	
White slate	32	1382	
Coal, (Winifrede?)	3	1385	173′
Slate	12	1397	
Sand	10	1407	
Slate	131	1538	

	Thickness. Feet.	Total. Feet.	
Sand	43	1581	
Black slate	54	1635	
Sand	70	1705	
Black slate	19	1724	
Sand	10	1734	
Black slate	79	1813	
Sand	24	1837	
Coal	3	1840	455'
White slate	5	1845	
Sand	25	1870	
Black slate	4	1874	
Sand	5	1879	
Coal	6	1885	45'
Lime	10	1895	
Black slate	8	1903	
Lime	17	1920	
Sand (Raleigh?), Salt of Rosedale (gas at 1605' in depth)	95	2015	
White slate	12	2027	142'
Mauch Chunk Series (182')			
Red rock	110	2137	
Pencil slate	17	2154	
Lime	25	2179	
Slate	3	2182	
Sand	14	2196	
Pencil slate	13	2209	182'
Greenbrier Limestone (80')			
Big Lime	80	2289	80'
Pocono Sandstones (400')			
Big Injun Sand	100	2389	
Red rock	10	2399	
Slate and shells	290	2689	400'
Catskill and Chemung Series (739')			
Slate and shells to bottom	739	3428	739'

"Conductor, 18'; 10" casing, 191'; 8¼" casing, 788'; 6⅝" casing, 1904'. All casing pulled. Finished November 8, 1904."

The foregoing section is very important, in that the entire thickness and details are given for the Conemaugh, Allegheny, and Pottsville Series. It also shows the Upper Freeport Sandstone in normal development, the latter being a very important "key-rock" on the waters of Elk River between Sutton and Queen Shoals. The red shales extend 100 to 125 feet lower down in the Conemaugh than in the northern counties of the State, a feature that is in harmony with the crop exposures of this formation in Clay County and southwestern Braxton.

One mile and a quarter southward, the following section was measured with aneroid by Gawthrop down the east hillside of Right Fork of Steer Creek:

Section 1.1 Miles North of Dessie, Birch District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (205')			
Concealed and sandstone, massive, coarse-grained, pebbly, **Upper Sewickley**	50	50	
Concealed with sandstone	35	85	
Sandstone, flaggy, medium-grained	15	100	
Sandstone, massive, brown, medium-coarse, makes cliff, **Cedarville**	25	125	
Concealed	80	205	
Bench, **Pittsburgh Coal horizon** (1030' B.)	..	205	205'
Conemaugh Series (145')			
Concealed	60	265	
Sandstone, massive, coarse, pebbly, **Lower Pittsburgh** (945' B.)	25	290	
Concealed to run (885' B.)	60	350	145'

The following section was measured with aneroid by the writer southeastward along the hill road to Laurel Run, a tributary of Duck Creek. The intervals are less than they should be, owing to rapid southeast rise of the strata:

Section 1.3 Miles South of Servia, Birch District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (420')			
Concealed, mostly sandy shale, brown, from **Pittsburgh bench**	50	50	
Sandstone, conglomeratic, large quartz pebbles, **Lower Pittsburgh**	40	90	
Concealed, steep slope	10	100	
Bench, concealed, flat, and shale, sandy	30	130	130'
Sandstone, fine-grained, green	20	150	
Shale, red, mostly concealed	40	190	
Sandstone, medium-grained, green	35	225	
Concealed, mostly red shale	30	255	
Shale, red	5	260	
Sandstone, current-bedded, medium-grained, green, **Grafton**	40	300	170'
Concealed, steep slope	25	325	
Bench	5	330	
Concealed, with red shale	60	390	
Concealed, with **horizon of Bakerstown? Coal** at base	25	415	
Fire clay, brown, flinty (905' B.)	5	420	120

Slightly over 6 miles northeastward in the same District, the following section, starting about 525 feet below the Pittsburgh Coal, was measured by Gawthrop on the west hillside of Big Run:

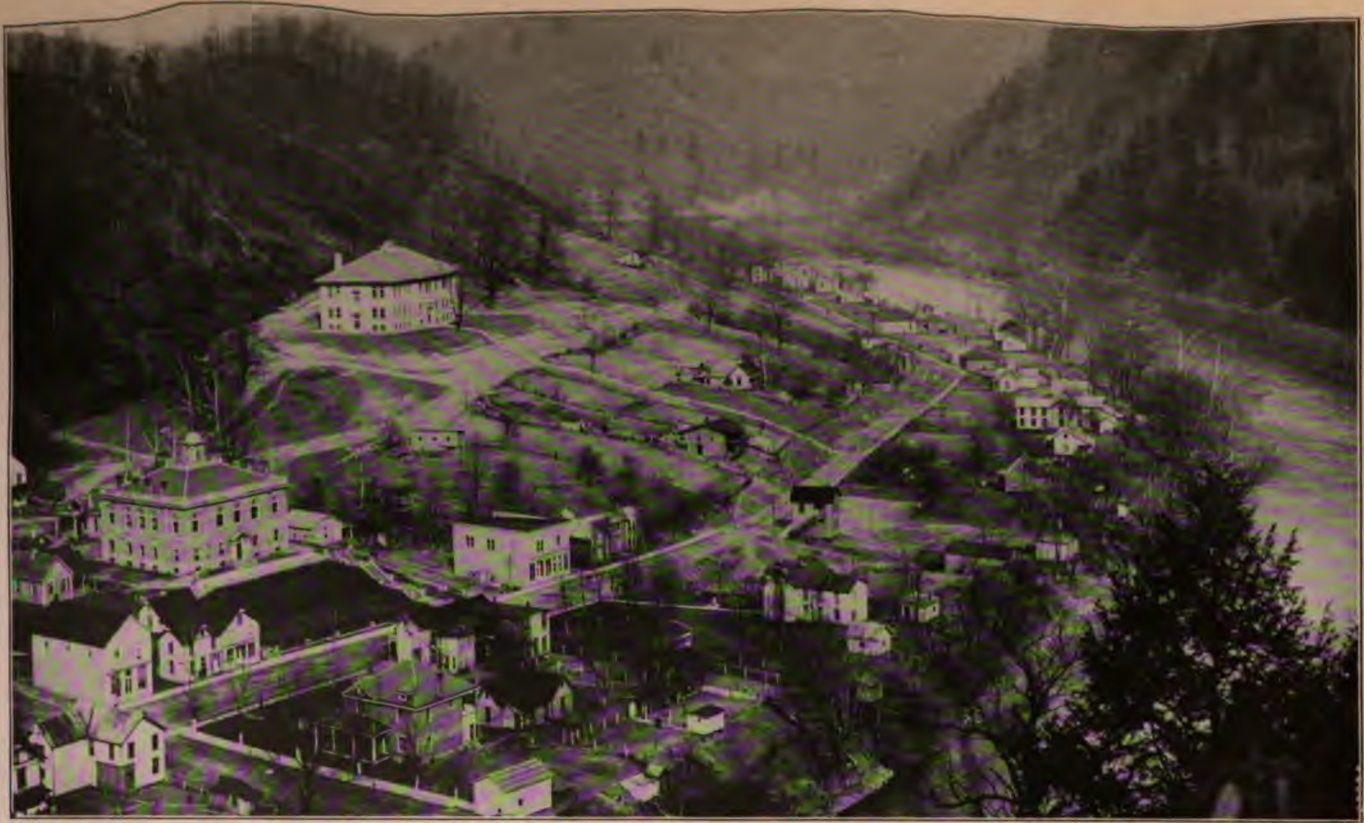

PLATE IV.—Showing Clay, County-Seat of Clay County, looking eastward up Elk River, and topography of Kanawha Group, Pottsville Series.

Section ¾ Mile Northeast of Frametown, Birch District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (88')			
Concealed and fire clay	1	1	
Shale	2	3	
Sandstone, shaly, brown, **Upper Mahoning**	20	23	
Shale, brown, siliceous, partly concealed	25	48	
Fire clay	1	49	
Coal, slaty, (1"), Mahoning (865' B.)	...	49	49'
Fire clay	2	51	
Sandstone, brown, shaly....17' Sandstone, massive, medium-grained, gray, micaceous.15 } **Lower Mahoning**	32	83	
Shale, blue, 0" to 3' **Uffington**	3	86	
Iron ore, 0" to 2'	2	88	39'
Allegheny Series (15')			
Coal (1"), Upper Freeport	0	88	
Shale, blue, with iron ore nodules, 0" to 2'	2	90	
Sandstone to railroad	3	93	
Concealed	5	98	
Sandstone, massive, in run (810' B.)	5	103	15'

The following section was measured with aneroid by the writer from the summit of Eli Taylor Knob southeastward to the mouth of a run, 0.2 mile southwest of Frametown. Owing to a rise of the rocks in this direction, the results are slightly less than they should be, although a part of this dip was compensated for by carrying the top of the Upper Mahoning Sandstone from the head of the run mentioned to its mouth and the basal portion of the section determined at the latter point:

Frametown—Eli Taylor Knob Section, Birch District.

	Thickness. Feet.	Total. Feet.
Monongahela Series (175')		
Sandstone, massive, coarse, brown, conglomeratic, large quartz pebbles, from summit of knob, **Upper Sewickley**	30	30
Concealed and shale	5	35
Sandstone, basal 5' coarse and pebbly, flaggy, medium-grained, green, micaceous, **Cedarville**	65	100
Concealed and coal	69	169

		Thickness. Feet.	Total. Feet.	
Coal, bright......1' 0"				
Bone 0 2				
Coal 1 0				
Shale, dark.......0 3				
Coal, bright......0 3	**Pittsburgh**......... (No. 208 on Map II) (1390' B.)	6	175	175'
Coal, slaty.......0 1				
Coal, semi-splint..2 0				
Shale, dark, hard.0 4				
Coal 0 11				
Conemaugh Series (602')				
Slate and concealed, steep slope		110	285	
Bench, flat, **Little Clarksburg**		5	290	
Shale, red and green		60	350	
Sandstone, medium-grained, greenish-gray, **Lower Connellsville**		30	380	205'
Concealed, gentle slope		45	425	
Sandstone, green, fine-grained		20	445	
Spring		...	445	
Concealed to bench		40	485	
Shale, red		10	495	
Sandstone, green, fine-grained		10	505	
Concealed to slight bench		60	565	
Sandstone		5	570	
Concealed, mostly red shale		25	595	
Shale, green and red, alternating		10	605	
Sandstone, **Buffalo**		40	645	
Concealed		55	700	
Spring, **Brush Creek Coal horizon**		...	700	320'
Sandstone, massive, coarse-grained, brown, pebbly, **Upper Mahoning**		25	725	
Concealed		3	728	
Shale		11	739	
Limestone, Sutton		1	740	40'
Sandstone, massive, coarse-grained, pebbly, **Lower Mahoning**		35	775	
Shale, **Uffington**		2	777	37'
Allegheny Series (36')				
Coal blossom, Upper Freeport (815' B.)		1	778	
Concealed		7	785	
Sandstone, massive, **Upper Freeport**		10	795	
Concealed to Elk River		18	813	36'

The following succession is obtained in the eastern edge of Birch District, Braxton County, by combining a section measured with aneroid by the writer, starting at the top about flush with the horizon of the Pittsburgh Coal, westward mostly along the hill road on the head of Diatter Run, with the log of the W. F. Duffield Diamond Drill Boring (No. 32 on Map II), the details of which were published on page 570 of Volume II(A) of the State Geological Survey Reports. The correlations of the coals in the well record have been changed to harmonize with the results of the detailed work for the season of 1915. The thickness of the Conemaugh Series is about 50 feet greater than it should be owing to a dip in the strata of that amount to the northwest:

Twistville—Diatter Run Section, Birch District.

	Thickness. Ft.	In.	Total. Ft.	In.	
Conemaugh Series (680')					
Concealed, steep slope, from top of knob	25	0	25	0	
Concealed, steep slope, with pebbly boulders, **Lower Pittsburgh**	45	0	70	0	
Bench	10	0	80	0	
Sandstone, partly concealed, **Connellsville**	70	0	150	0	
Concealed and red shale	75	0	225	0	
Concealed, mostly sandstone	60	0	285	0	
Concealed, mostly sandstone, **Grafton**, in lower half, and green shale	91	10	376	10	
Coal, slaty.....1' 0" Slate ....0 8 Coal, good.....1 6 **Harlem** (No. 17 on Map II) (1315' B.)	3	2	380	0	380' 0"
Concealed to bench	15	0	395	0	
Sandstone, massive	10	0	405	0	
Concealed	5	0	410	0	
Shale	10	0	420	0	
Sandstone, massive, medium-grained, green	10	0	430	0	
Shale, sandy	5	0	435	0	
Sandstone, **Saltsburg**	40	0	475	0	95' 0"
Concealed	15	0	490	0	
Sandstone	15	0	505	0	
Concealed	20	0	525	0	
Shale, red, partly concealed	35	0	560	0	
Concealed	5	0	565	0	
Sandstone	10	0	575	0	
Concealed, with sandstone	20	0	595	0	
Fire clay shale	5	0	600	0	
Sandstone, shaly	5	0	605	0	
Concealed	5	0	610	0	
Shale, brown and sandy	5	0	615	0	
Concealed	10	0	625	0	
Shale, brown, sandy	5	0	630	0	
Sandstone, shaly	5	0	635	0	
Concealed, with iron and shale	15	0	650	0	
Sandstone, green	10	0	660	0	
Concealed and shale	20	0	680	0	205' 0"
Allegheny Series (287' 9")					
Coal blossom, Upper Freeport, 0" to	1	0	681	0	
Sandstone, Upper Freeport, to top of boring	19	0	700	0	
Continued with Log Coal Test Boring (No. 32 on Map II):					
Surface	4	2	704	2	

	Thickness. Ft.	In.	Total. Ft.	In.	
Sandstone, Upper Freeport	79	4	783	6	
Shale, sandy	41	6	825	0	
Fire clay	2	0	827	0	
Sandstone, solid, Lower Freeport	19	5	846	5	
Black slate	2	0	848	5	
Coal 0' 9" Fire clay 1 0 Coal 0 2 Upper Kittanning	1	11	850	4	170' 4"
Fire clay	2	2	852	6	
Sandy slate	3	0	855	6	
Sandstone, Upper East Lynn	22	2	877	8	
Coal	0	4	878	0	
Sandstone	7	8	885	8	
Fire clay	2	2	887	10	
Sandstone	2	3	890	1	
Shale, greenish	9	11	900	0	
Shale and fire clay	6	6	906	6	
Dark slate	6	0	912	6	
Light sandy shale	10	6	923	0	
Black slate, Middle Kittanning Coal horizon	1	10	924	10	74' 6"
Fire clay	2	6	927	4	
Sandy shale	21	2	948	6	
Black slate	2	6	951	0	
Sandstone, East Lynn	10	11	961	11	
Coal 0' 3" Slate 0 7 Coal 3 3 "No. 5 Block" Lower Kittanning (705' B.)	4	1	966	0	41' 2"
Fire clay	1	9	967	9	
Pottsville Series (17' 6")					
Sandstone, Homewood, to bottom	17	6	985	3	19' 3"

Slightly over two miles southward in the same District, the writer measured the following section with aneroid from the summit of a high knob, 1 mile northeast of Herold, southwestward along the hill road to Birch River at the latter post-office. Owing to a rise of about 75 feet in the strata in this direction, the results are less than they should be:

Section Northeast Edge of Herold, Birch District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (290')			
Shale, brown, from summit of knob	20	20	
Sandstone, coarse, brown, pebbly, Grafton	35	55	55'
Concealed	5	60	
Shale, red and green 10' Shale, red 10 Pittsburgh	20	80	
Sandstone, green, Jane Lew	10	90	
Concealed, mostly red shale	40	130	
Sandstone, very hard, grayish-white, siliceous, Saltsburg	3	133	

	Thickness. Feet.	Total. Feet.	
Concealed	3	136	
Fire clay, flinty, red	4	140	
Shale, red and variegated	25	165	
Sandstone, green, coarse	10	175	
Shale, sandy, red, and variegated	25	200	
Spring, fire clay, horizon of Brush Creek Coal	5	205	150′
Sandstone, green, fine-grained	10	215	
Concealed and fire clay	5	220	
Concealed	5	225	
Sandstone, green, fine-grained	25	250	
Concealed and fire clay	40	290	85′
Allegheny Series (270′)			
Sandstone, Upper Freeport, coarse-grained, brown, conglomeratic, pebbly in basal portion	70	360	
Concealed	35	395	
Fire clay	1	396	
Sandstone, grayish-white and hard, Lower Freeport	24	420	
Concealed	40	460	170′
Sandstone, with shale layers, Upper East Lynn	15	475	
Concealed	45	520	60′
Shale, fire clay, dark, Middle Kittanning Coal horizon	5	525	
Sandstone, grayish-white, makes great cliff at Herold, East Lynn	30	555	
Coal, "No. 5 Block," Lower Kittanning (940′ B.)	5	560	40′
Pottsville Series—Kanawha Group (55′)			
Sandstone, Homewood, grayish-white, current-bedded, to bed to Birch River, at ford just below Herold	55	615	55′

On the opposite side of Birch River at Herold, the following section was measured by I. C. White and published in Volume II(A) of the State Survey Reports, page 569, the slight additions and changes in parentheses being by the writer:

Section, South Edge of Herold, Birch District.

	Thickness.		Total.		
Allegheny Series (224′ 2″)	Ft.	In.	Ft.	In.	
Sandstone, great pebbly cliff, (Upper Freeport)	50	0	50	0	
Concealed and sandstone	40	0	90	0	
Coal, (Upper Kittanning)	1	6	91	6	91′ 6″
Shale, sandstone, and concealed	80	0	171	6	80′ 0″
Fire clay, visible, (Middle Kittanning Coal horizon at top)	3	0	174	6	

		Thickness. Ft.	In.	Total. Ft.	In.	
Sandstone, massive, pebbly, (East Lynn)		45	0	219	6	
Slate, black		0	2	219	8	
Coal ....2' 0"	("No. 5 Block") Lower Kittanning? (945' B.)	4	6	224	2	52' 8"
Shale, gray....0 9						
Coal, soft......0 8						
Coal, splint....0 6						
Coal, harder...0 7						
Pottsville Series (50')						
Concealed and massive sandstone to bed of Birch River		50	0	274	2	50' 0"

The following accurate detailed section of the Allegheny Series, made up of the log of a diamond drill boring, published on page 568 of Volume II(A) of the State Geological Survey Reports, contains much data of interest and corroborates the correlations of the Twistville—Diatter Run Section on a preceding page of this Chapter. This boring—No. 30 on Map II—is located on the east bank of Canoe Run, opposite Glendon, 75 feet northwest of the public highway along Elk River, and starts about 60 feet below the top of the great conglomeratic Upper Freeport Sandstone and about 710 feet below the Pittsburgh Coal. The identifications in parentheses are the results of the investigations in gathering data for this Report:

Glendon Section, Birch Distruct.

(Log of J. C. Dean Boring—No. 30 on Map II.)

		Thickness. Ft.	In.	Total. Ft.	In.	
Allegheny Series (231') (801' L.)						
Surface		11	2	11	2	
Sandstone, (Upper Freeport)		14	10	26	0	
Sandy shale		21	0	47	0	
Black slate, (Lower Freeport Coal horizon)		6	0	53	0	
Sandstone, (Lower Freeport)		12	0	65	0	
Dark slate		5	0	70	0	
Light slate		4	0	74	0	
Black slate		1	0	75	0	
Coal, (Upper Kittanning "Rider")		0	1	75	1	
Fire clay		1	11	77	0	
Sandy shale		12	3	89	3	
Coal ....0' 2"	Upper Kittanning. (708' L.)	3	4	92	7	92' 7"
Dark slate.....2 2						
Coal 1 0						
Fire clay		3	5	96	0	
Dark slate		4	6	100	6	
Sandstone, (Upper East Lynn)		61	9	162	3	

		Thickness. Ft.	In.	Total. Ft.	In.	
Light shale		1	6	163	9	
Sandstone		1	6	165	3	
Black slate		8	1	173	4	
Coal ....1' 10" Slate ....0 1 Coal ....0 6 Black slate..5 5½ Coal ....0 6 Black slate..0 3	Middle Kittanning.	8	8	182	0	89' 5"
Sandstone.. 1' 7" Sandy slate. 3 0 Sandstone .28 2	East Lynn	32	9	214	9	
Coal ....0' 6" Parting .....0 2 Coal 3 6	Lower Kittanning ("No. 5 Block")	4	2	218	11	36' 11"
Fire clay		0	5	219	4	
Dark slate to bottom		11	8	231	0	12' 1"

The following section, measured by I. C. White and published on page 566 of Volume II(A) of the State Geological Survey Reports, was determined eastward from the summit of Long Knob to Elk River at Strange Creek, roughly along the strike of the rocks. The additions and changes in correlations in parentheses harmonize with the classification of the members in the Twistville and Glendon Sections, given on preceding pages of this Chapter:

Strange Creek Section, Birch District.

	Thickness. Ft.	In.	Total. Ft.	In.	
Conemaugh Series (591')					
Sandstone, (Connellsville), from top of Long Knob	30	0	30	0	
Concealed and red shales	50	0	80	0	
Sandstone, massive, pebbly, (Lower Connellsville)	30	0	110	0	
Concealed with iron ore and ferruginous limestone	40	0	150	0	
Concealed	80	0	230	0	
Sandstone, massive, pebbly, (Grafton)	50	0	280	0	280' 0"
Concealed	20	0	300	0	
Limestone, nodular, (Ewing)	5	0	305	0	
Red shales with limestone nodules	75	0	380	0	
Limestone, (Pine Creek)	1	0	381	0	
Deep-red shales and concealed	80	0	461	0	
Sandstone, massive and concealed, with nuggets of iron ore weathering red at base	130	0	591	0	311' 0"

	Thickness.		Total.		
	Ft.	In.	Ft.	In.	
Allegheny Series (213' 7")					
Sandstone, massive, pebbly, (Upper and Lower Freeport)	119	0	710	0	
Coal, blossom	...	..	710	0	
Concealed	10	0	720	0	
Sandstone, massive	10	0	730	0	
Shales, sandy	10	0	740	0	
Fire clay, coaly, (Upper Kittanning "Rider")	3	0	743	0	
Shales and sandstone concretions	15	0	758	0	
Shales, sandy	7	0	765	0	
Coal 0' 2" Fire clay 1 1 Coal 0 4 Upper Kittanning (820' B.) (Exposure No. 422 on Map II)	1	7	766	7	175' 7"
Fire clay	5	0	771	7	
Sandstone, shaly 3' 0" Sandstone, massive, to Elk River 30 0 Upper East Lynn	33	0	804	7	38' 0"

The coal at 765 feet from the top in the foregoing section is undoubtedly the same bed as that at 848' 5" and 89' 3" from the top in the Twistville—Diatter Run, and Glendon Sections, respectively, on preceding pages of this Chapter.

The following section was measured by the writer with aneroid southward from the summit of a high knob mostly along a deep ravine on the north hillside of Elk to the bed of the river, one mile northwest of Strange Creek Station. Owing to the north dip of the strata, the results are slightly less than they should be:

Section One Mile Northwest of Strange Creek, Birch District.

	Thickness.	Total.
	Feet.	Feet.
Conemaugh Series (360')		
Shale, sandy, and concealed from top of knob	15	15
Sandstone, green	20	35
Concealed and red shale	50	85
Sandstone, green	25	110
Concealed	5	115
Concealed, mostly red shale	40	155
Concealed	25	180
Sandstone, green, fine-grained, micaceous	20	200
Concealed	27	227
Fire clay, flinty, siliceous, red	18	245
Sandstone, coarse, brown, massive, Upper Mahoning	30	275
Concealed	3	278

	Thickness. Feet.	Total. Feet.	
Shale, bluish-gray	5.7	283.7	
Coal, mostly slate, **Mahoning**	1.3	285	
Concealed, gentle slope	75	360	360'
Allegheny Series (200')			
Sandstone, grayish-white, massive, with large white quartz pebbles, **Upper Freeport**	70	430	
Concealed	5	435	
Sandstone, flaggy, with 12" limy layer 30' above base, **Lower Freeport**	50	485	
Concealed	5	490	
Coal blossom, Upper Kittanning "Rider"	..	490	
Fire clay shale, visible	1	491	
Concealed	14	505	145'
Sandstone, massive, current-bedded, grayish-white, **Upper East Lynn**	35	540	
Concealed to Elk River	20	560	55'

In the southern edge of Birch District, Braxton, the following section was measured with aneroid by Gawthrop northward along the hill road on the head of Mill Run, 2 miles south of Strange Creek Station, on the dip of the rocks:

Section at Head of Mill Run, Birch District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (385')			
Concealed and sandstone, massive, soft, dark-drown	15	15	
Shale, red	5	20	
Concealed	15	35	
Sandstone, partly concealed	10	45	
Shale, red	10	55	
Limestone, reddish-gray, hard, **Ewing?** (1385' B.)	1	56	56'
Shale, red	4	60	
Sandstone	5	65	
Shale, red, partly concealed	35	100	
Concealed, mostly shale	90	190	
Sandstone, massive, hard	10	200	
Concealed	185	385	
Allegheny Series (110')			
Sandstone, massive, coarse-grained, large quartz pebbles, small concealed interval, **Upper Freeport** (top, 1055' B.)	50	435	379'
Concealed	45	480	
Fire clay and **coal trace, Lower Freeport**	2	482	47'
Concealed	8	490	
Shale, blue, with iron nodules (945' B.)	5	495	13

The following section was measured with aneroid along the hill road northwestward to the bed of Strange Creek at the mouth of Frame Run, ¾ mile due west of Jennings. The results are greater than they should be, owing to the northwest dip of the strata at this locality:

Section ½ Mile West of Jennings, Birch District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (170')			
Red shale, gray shale, sandstone, and concealed	25	25	
Sandstone, partly concealed	10	35	
Concealed, with reddish-brown shale	28	63	
Fire clay	2	65	
Concealed	105	170	170'
Allegheny Series (290')			
Sandstone, massive, coarse-grained, brown, large quartz pebbles..........30' Concealed ....40 Sandstone, massive, coarse-grained, brown, pebbly..10 **Upper Freeport..**	80	250	
Concealed to bench	90	340	
Concealed	38	378	
Coal blossom, Upper Kittanning, (4") (945' B.)	...	378	208'
Concealed	2	380	
Sandstone, massive, gray, medium-grained, micaceous, **Upper East Lynn**	30	410	
Concealed	20	430	
Sandstone	10	440	
Concealed, with shale	5	445	
Coal, Middle Kittanning, (875' B.)	1.5	446.5	68.5'
Shale	1	447.5	
Sandstone	4	451.5	
Concealed to Strange Creek (860' B.)	8.5	460	13.5'

The following section, measured with aneroid by the writer northeastward along the hill road to an opening in the "No. 5 Block" Coal, near the bed of Strange Creek, 0.4 mile east of Jennings, shows closely the intervals between members of the Allegheny Series in southern Birch District, Braxton County:

Section 0.4 Mile Southeast of Jennings, Birch District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (90')			
Sandstone, **Upper Mahoning**	20	20	
Concealed, fire clay shale, **Mahoning Coal horizon**	5	25	
Sandstone in steep slope, **Lower Mahoning**	65	90	90'

	Thickness. Feet.	Total. Feet.	
Allegheny Series (295')			
Bench, Upper Freeport Coal horizon	10	100	
Sandstone, conglomeratic, large quartz pebbles, coarse-grained, brown, Upper Freeport	95	195	
Bench, Lower Freeport Coal horizon	5	200	
Sandstone, Lower Freeport	55	255	165'
Bench, Upper Kittanning Coal horizon (1030' B.)	5	260	
Concealed, steep slope	120	380	
Coal, "No. 5 Block," Lower Kittanning (No. 619 on Map II), (905' B.)	5	385	130'

The following section was measured with aneroid by Gawthrop southwestward down the hillside of Strange Creek to the bed of the latter at its intersection with the Braxton-Nicholas County Line, roughly on the strike of the rocks:

Section 2 Miles Southeast of Jennings, Birch District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (220')			
Concealed, holding in upper portion massive, brown, very pebbly sandstone, Upper Freeport	75	75	
Sandstone, massive, Lower Freeport	5	80	
Concealed	25	105	105'
Sandstone, massive, grayish-brown, medium-grained, medium-hard, with a few small pebbles, Upper East Lynn	40	145	
Concealed	45	190	
Sandstone, massive, East Lynn	15	205	
Concealed, holding coal, "No. 5 Block," (1120' B.)	15	220	115'
Pottsville Series—Kanawha Group (115')			
Sandstone, massive, hard, medium-grained, gray, Homewood	70	290	
Concealed	3	293	
Sandstone, massive	5	298	
Concealed	2	300	
Sandstone, massive, gray, hard, to Strange Creek (1005' B.)	35	335	115

Holly District (Braxton) Sections.

Holly District lies in the southeast corner of Braxton County and its surface rocks belong mostly in the Allegheny and Pottsville Series, although there are small areas of both the Monongahela and Conemaugh along its northern border.

In the northwest corner of the District, the following section was measured with aneroid by the writer from the summit of the hill just south of Fisher Knob eastward mostly along the hill road to the Baltimore and Ohio Railroad grade, 0.4 mile south of the railway station at Flatwoods. The results are less than they should be owing to the northwest dip of the rocks:

Section 0.5 Mile Southwest of Flatwoods, Holly District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (300')			
Sandstone, coarse, brown, pebbly, Gilboy, from just below top of Fisher Knob....	10	10	
Concealed, steep slope....................	45	55	
Sandstone, flaggy, fine-grained, green, Arnoldsburg	30	85	
Shale, sandy, and concealed................	10	95	
Sandstone, fine-grained, green, flaggy, Upper Sewickley	40	135	
Concealed, steep slope....................	15	150	
Bench, flat...............................	5	155	
Concealed, steep slope....................	20	175	
Bench, Sewickley Coal horizon.............	5	180	180
Sandstone, hard, limy, green, Cedarville....	40	220	
Concealed, bench..........................	5	225	
Concealed, slope..........................	15	240	
Sandstone, green, micaceous, flaggy, Weston	20	260	
Concealed, steep slope, to bench, Pittsburgh	40	300	120'
Conemaugh Series (235')			
Concealed	15	315	
Shale, red, and thin sandstone, alternating, partly concealed.......................	135	450	
Sandstone, green..........................	5	455	
Shale, red................................	30	485	
Sandstone	10	495	
Shale, yellow, sandy......................	4.7	499.7	
Coal, Elk Lick............................	0.3	500	200'
Fire clay shale...........................	5	505	
Sandstone, Grafton, to B. & O. R. R. grade, road crossing (1178' L.)...............	30	535	35'

Slightly less than 5 miles eastward in the same District the writer measured with aneroid the following section southward from the summit of "High Knob" to an opening in the Bakerstown Coal, the total northwest dip of the strata between the two extremes being slightly less than 25 feet:

High Knob Section, Holly District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (340')			
Concealed from summit of High Knob......	10	10	
Sandstone, green, flaggy, **Connellsville**......	35	45	45'
Shale, red, and concealed..................	20	65	
Sandstone, green, fine-grained, **Lower Connellsville**	25	90	
Concealed	115	205	
Fire clay shale, dark trace................	...	205	
Concealed	20	225	
Shale, green, sandy, apparent fragments of marine fossils, **Ames**..................	5	230	185'
Concealed	5	235	
Sandstone	15	250	
Concealed	5	255	
Shale, red................................	10	265	
Sandstone, **Saltsburg**........................	65	330	
Shale, dark................................	5	335	
Coal, Bakerstown (1375' B.)...............	5	340	110

In the western edge of Holly District, Braxton, the following succession is obtained by combining an aneroid section measured by the writer from the summit of Hog Knob southward to an opening in the Upper Freeport Coal on the north hillside of Elk, ¼ mile west of the mouth of Bee Run, with the detailed log of the Haymond No. 1 Well (No. 77 on Map II), located on the north bank of the river opposite Bison), the record of which was published by I. C. White in 1899 on page 270 of Volume I of the State Geological Survey Reports. The section is very important, in that the position of the Sutton Limestone is exhibited along with details of both the Allegheny and Pottsville Series. In that portion made up from the well record, the changes and additions of correlation of members from that as originally published are indicated in parentheses. The thickness shown for the Conemaugh is 25 to 30 feet less than it should be, owing to a rise of about that amount in the strata in the direction the measurements for that portion were determined:

Sutton Section, Holly District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (115')			
Shale and sandstone, from summit of Hog Knob	30	30	
Concealed	35	65	
Sandstone, **Weston**	50	115	115
Conemaugh Series (602.5')			
Concealed in bench	15	130	
Sandstone, massive, greenish-gray **Lower Pittsburgh**	45	175	
Concealed in steep slope	25	200	
Concealed in bench	10	210	
Sandstone, fine-grained, micaceous, green, partly concealed, Connellsville	65	275	160'
Concealed in bench	15	290	
Sandstone, micaceous, green	25	315	
Concealed in bench	20	335	
Concealed	10	345	
Sandstone, micaceous, green, **Morgantown**	35	380	105'
Concealed	5	385	
Spring, **Elk Lick Coal horizon?**	...	385	
Limestone, nodular, Elk Lick, and concealed	5	390	10
Concealed and red shale	50	440	
Sandstone, massive, and concealed	50	490	
Fire clay shale	5	495	
Sandstone, medium-grained	20	515	
Concealed and shale	10	525	
Sandstone, massive to current-bedded, coarse, conglomeratic at top, **Buffalo**	20	545	
Concealed, bench	10	555	
Sandstone, medium-grained, greenish-gray	40	595	
Concealed	15	610	
Concealed and shale, bench	10	620	230'
Sandstone, massive, medium-grained, gray and brown, makes cliff, **Upper Mahoning**	45	665	
Shale, buff and gray	2	667	
Limestone, Sutton, lenticular	1	668	
Shale	...	...	
Coal ....0' 10½" Shale, gray..0 2½ **Coal** ....0 11 } **(Exposure 45 on Map II) Mahoning Coal** (Exposure, mouth of Old Woman Run)	2	670	
Shale	5	675	
Sandstone, massive, medium-grained, pebbly, making cliff, **Lower Mahoning**	42.5	717.5	97.5'
Allegheny and Pottsville Series (1367.5')			
Coal, Upper Freeport	2.5	720	
Continued with Log of Haymond No. 1 Well (No. 77 on Map II):			
Unrecorded to 50 ft. in depth in well	15	735	
Slate, blue	30	765	
Sand, white, *(Lower Freeport)*	80	845	
Coal, (Upper Kittanning)	6	851	133.5'
Sand, white, *(Upper East Lynn, East Lynn, and Homewood)*	230	1081	

	Thickness. Feet.	Total. Feet.	
Slate, black	50	1131	
Sand, gray	100	1231	
Slate, black	20	1251	
Lime, brown	75	1326	
Slate, black	30	1356	505'
Sand, gray, (salt water)	50	1406	
Slate, black	75	1481	
Sand, gray	20	1501	
Lime, white	50	1551	
Slate, black	40	1591	
Sand, gray	50	1641	
Slate, blue	60	1701	
Lime, gray	55	1756	
Slate, blue	54	1810	
Sand, yellow, (salt water)	25	1835	
Slate	40	1875	
Sand, gray and white	210	2085	729'
Mauch Chunk Series (90')			
Slate, white	30	2115	
Lime	35	2150	
Red rock	15	2165	
Slate, black	10	2175	90'
Greenbrier Limestone (70')			
Big Lime	50	2225	
Slate, white	20	2245	70'
Pocono, Catskill, and Chemung Series (1165')			
Sand, little black oil, Big Injun	15	2260	
Lime, white and gray (6⅝" casing at 1590')	290	2550	
Slate, black	50	2600	
Slate and shells	360	2960	715'
Sand, white, little oil, Fifth	5	2965	
Slate and shells to bottom	445	3410	450'

In the same District, the following section was measured with aneroid by Gawthrop northwestward down the east hillside of Buckeye Creek, 1.3 miles southeast of Sutton. The intervals are greater than they should be, owing to the northwest dip of the strata:

Buckeye Creek Section, Holly District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (105')			
Sandstone, shaly	5	5	
Shale, dark, siliceous	5	10	
Coal 0' 7" Shale, with coal streaks 0 11 Coal, good 1 8 } **Mahoning** (47 on Map II) (1090' B.)	3.2	13.2	13.2'
Shale and concealed	81.8	95	
Sandstone, shaly	5	100	

	Thickness. Feet.	Total. Feet.	
Shale, dark, with plant fossils, **Uffington**....	5	105	91.8'
Allegheny Series (70')			
Coal, Upper Freeport, (No. 308 on Map II) (995' B.)............................	1.7	106.7	
Shale and concealed......................	8.3	115	
Sandstone, massive, brown..10' Concealed ....15 Sandstone, massive, coarse-grained, brown..........20 — **Upper Freeport**..	45	160	
Concealed to bed of Buckeye Creek (925' B.)	15	175	70.0'

The following section was measured with aneroid by the writer westward down the long point to the bed of Elk River at the mouth of Flatwoods Run. The results above the top of the Upper East Lynn Sandstone are greater than they should be, owing to the rise of the strata in the opposite direction:

Section 1 Mile Northwest of Gillespie, Holly District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (257')			
Shale, yellowish-brown....................	9	9	
Iron ore, hollow lenses, 6" in diameter and 8" to 10" long, walls 1" thick, **Lower Freeport**	1	10	
Shale, yellowish............................	10	20	
Sandstone, current-bedded, grayish-white, makes great cliff, **Lower Freeport**......	65	85	
Concealed, bench, and slate, **Upper Kittanning Coal**............................	45	130	130'
Sandstone, current-bedded, grayish-white, medium-grained, makes great cliff, **Upper East Lynn**............................	60	190	
Concealed	29	219	
Sandstone, massive, **East Lynn**.............	19.3	238.3	
Coal, good...........1' 2" Shale, gray..........0 3 **Coal, good**..........0 4 — **Lower Kittanning Upper Bench**... (970' B.)	1.7	240	
Shale, gray................................	1.5	241.5	
Sandstone, flaggy and shaly................	3.5	245	
Coal, slaty.............0' 1" Shale, gray, 4" to......0 10 **Coal, slaty**.............0 1 — **Lower Kittanning... Lower Bench**	1	246	116'
Shale, gray................................	11	257	
Pottsville Series (103')			
Sandstone, flaggy, to B. & O. R. R. grade...	3	260	
Concealed to Elk River (850' B.)...........	100	360	114'

The following section was measured with aneroid by the writer on the north hillside of Elk River at Palmer. That portion above the base of the Lower Kittanning Coal was determined southeastward from the summit of the knob, 0.6 mile northeast of Holly Junction, to the old abandoned mine in the latter bed, the details of which are as published by I. C. White on page 522 of Volume II(A) of the State Geological Survey Reports, the openings being closed when visited during 1915. That portion below the coal in question was measured southwestward along the point to just below the West Virginia Midland Railway Station at Palmer. The section is important, in that the interval between the Lower Kittanning and Stockton Coals is exhibited. It also shows the horizon of the marine fossiliferous Winifrede Limestone:

Palmer Section, Holly District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (60')			
Sandstone, coarse, brown, top flaggy, and medium-grained bottom, Lower Mahoning	50	50	
Concealed	10	60	60'
Allegheny Series (270')			
Concealed in bench, Upper Freeport Coal horizon	15	75	
Sandstone, current-bedded, medium-grained, Upper Freeport	40	115	
Concealed, steep slope	25	140	
Concealed in flat bench, with iron ore, Lower Freeport	10	150	90'
Sandstone, current-bedded, medium-grained, grayish-white, forms cliff, Lower Freeport	60	210	
Shale, gray	1.7	211.7	
Coal, bony....... 1' 0" Coal, medium-soft.2 3 Upper Kittanning (No. 383 on Map II)	3.3	215	65'
Slate and concealed	10	225	
Sandstone, current-bedded, medium-grained, grayish-white, forms cliff, Upper East Lynn	60	285	
Shale, sandy, concealed, and slate	25.5	310.5	
Coal, hard, bony.0' 8" Slate, dark......0 5 Coal, good......1 2 Coal, bony......0 3 Coal, good, hard.1 4 "Mother" coal...0 2 Middle Kittanning (No. 520 on Map II)	4	314.5	
Sandstone, fine-grained, hard, East Lynn	2.5	317	
Coal, hard..2' 0" Shale, gray.3 0 Coal, softer.3 0 Lower Kittanning (Mine No. 566 on Map II) (1125' B.)	8	325	

	Thickness. Feet.	Total. Feet.	
Shale, sandy	5	330	115'
Pottsville Series—Kanawha Group (285')			
Sandstone, grayish-white, medium-grained, makes cliffs, **Homewood**	100	430	
Concealed	33	463	
Shale, sandy, buff	7	470	
Shale, dark, plant fossils, **Kanawha Black Flint horizon**?; no marine fossils seen	1.5	471.5	
Coal, gas 0' 6" Coal, slaty 1 4 Coal, medium-hard 1 8 } **Stockton** (No. 758 on Map II)	3.5	475	145'
Slate and concealed	70	545	
Sandstone	5	550	
Shale, sandy	14	564	
Shale, black, with marine fossil shells abundant, **Winifrede Limestone horizon**	6	570	
Shale, sandy, bluish-gray	4.3	574.3	
Coal, **Chilton**?	0.7	575	100'
Shale	2	577	
Sandstone to W. Va. Midland R. R. grade, Palmer Station	13	590	
Concealed to bed of Elk River	25	615	40'

The following section was measured with aneroid by the writer in a West Virginia Midland Railroad cut 1.3 miles southwest of Holly:

Section 1.3 Miles Southwest of Holly, Holly District.

	Thickness. Feet.	Total. Feet.
Pottsville Series—Kanawha Group (83')		
Shale, sandy, dark	1.5	1.5
Coal, soft 0' 6" Shale, sandy 0 5 Coal, medium-hard 0 7 } **Winifrede**	1.5	3.0
Shale, dark, sandy, holding marine fossils, **Winifrede Limestone**	20.0	23.0
Sandstone	10.0	33.0
Coal, **Chilton**?	0.7	33.7
Shale, concealed, and shale	20.3	54.0
Coal, **Hernshaw**?	1.0	55.0
Sandstone and shale	6.0	61.0
Slate, cannel 0' 10" Coal, medium-soft 1 0 } **Holly (Williamson?)**	1.8	62.8
Slate, gray	5.2	68.0
Sandstone, shaly, to W. Va. Midland Railroad grade (930' B.)	15.0	83.0

Slightly less than a mile northeastward along the same railway grade, the writer measured the following section at an exposure exhibiting the marine fossiliferous Winifrede

Limestone at the farthest point northeastward that is yet reported for it in the State, the correlation of the coals here being based on this stratum:

Section 0.8 Mile Southwest of Holly, Holly District.

	Thickness. Ft.	Thickness. In.	Total. Ft.	Total. In.
Pottsville Series—Kanawha Group (57' 1")				
Limestone, bluish-gray, lenticular, marine fossils abundant in top, **Winifrede**	1	3	1	3
Concealed, with **coal blossom, Chilton**	24	9	26	0
Shale, dark	5	0	31	0
Slate, black, **Linguli** fossils abundant	1	0	32	0
Coal, bony, **Hernshaw?**	1	3	33	3
Slate, dark-gray	1	0	34	3
Sandstone, hard, platy	1	6	35	9
Slate, dark, sandy	3	6	39	3
Slate, cannel, 8" to.......0' 10" **Coal**, medium-soft, 10" to.......1 0 **Holly (Williamson?)** (940' B.)	1	10	41	1
Shale, dark, argillaceous	5	0	46	1
Sandstone, shaly, to W. Va. Midland Railroad grade	11	0	57	1

The following section was measured with aneroid by the writer northward down the south hillside of Elk River. The results are slightly greater than they should be, owing to the northwest dip of the rocks:

Section ¼ Mile Southwest of Holly, Holly District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (60')			
Sandstone, grayish-white, conglomeratic, large white quartz pebbles, some 1" in diameter, **Lower Mahoning**	60	60	60'
Allegheny Series (290')			
Bench, **Upper Freeport Coal horizon**	10	70	
Concealed, mostly sandstone in steep slope	75	145	
Bench	5	150	
Concealed, steep slope	105	255	
Sandstone, grayish-white, coarse, platy, **East Lynn**	35	290	
Concealed, steep slope	35	325	
Concealed, bench, and shale with black slate	25	350	290'
Pottsville Series (310')			
Sandstone, grayish-white, platy, making great cliff, **Homewood**	80	430	
Concealed	10	440	
Sandstone, platy, making cliff	25	465	

	Thickness. Feet.	Total. Feet.	
Concealed	10	475	
Sandstone, current-bedded, making great cliff, medium-grained, grayish-brown	25	500	
Concealed	5	505	
Coal digging, Stockton, reported	5	510	160'
Concealed, steep slope	25	535	
Coal blossom and black slate, Coalburg	5	540	
Sandstone, platy	30	570	
Bench	10	580	
Concealed (980' B.)	80	660	150'

In the same District, the following section was measured with aneroid by Gawthrop down the hill road on the north side of Left Fork of Holly River at Marpleton, the section of the Marpleton (Cedar Grove?) Coal being added by the writer from measurements determined at the E. J. Stump bank immediately northwest of the road fork mentioned at the base of section. The results are slightly less than they should be, owing to the northwest dip of the rocks:

Marpleton Section, Holly District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (220')			
Concealed from top of knob	80	80	
Sandstone and concealed	50	130	
Sandstone, massive, current-bedded, **Upper East Lynn**	20	150	
Concealed	70	220	220'
Pottsville Series (505')			
Sandstone, **Homewood**	10	230	
Concealed	95	325	
Shale, gray, sandy	5	330	
Coal, weathered, slaty....1' 6" **Coal**....1 6 **Stockton.**	3	333	113'
Shale and concealed	17	350	
Sandstone	15	365	
Concealed	229	594	
Shale, gray, plant fossils	5	599	
Coal, gas....1' 0" Shale, gray....4 0 **Coal**, cannelly, thickness concealed, estimated....2 0 **"Marpleton"** (Cedar Grove?) (No. 936 on Map II)	6	605	272'
Concealed, to road fork at Marpleton (974' L.)	120	725	120'

In the same District, the following succession is obtained for Centralia by combining a section measured with aneroid by the writer with the log of a test well—No. 109F on Map II—at the latter point, the details of which were kindly furnished the Survey by W. T. Diggins of that place. The upper 625 feet of the column was determined southwestward on the north hillside of Elk River, 0.2 mile east of the mouth of Mill Creek; and the residue above the well mouth, with the exception of the Kanawha Black Flint and Stockton Coal, was measured southwestward down the point opposite the boring in question. The two members last mentioned were supplied from an opening in the Stockton bed in a branch of Laurel Creek, 0.5 mile southwest of the well in question:

Section for Centralia, Holly District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (60')			
Concealed along gentle slope from summit of high knob	60	60	60'
Allegheny Series (250')			
Sandstone, conglomeratic, large quartz pebbles, making great cliff, **Upper Freeport**	20	80	
Concealed	5	85	
Shale, yellowish-brown, with small fragments of iron ore, partly concealed	15	100	
Sandstone, grayish-brown, medium-coarse, making slight cliff, **Lower Freeport**	75	175	
Concealed, steep slope	...	175	
Bench, **Upper Kittanning Coal horizon**	15	190	130'
Sandstone, grayish-white, medium-grained, no pebbles seen, **Upper East Lynn**	30	220	
Concealed, steep slope	10	230	
Bench	10	240	
Concealed	25	265	
Sandstone, **East Lynn**	20	285	
Concealed, slope	10	295	
Concealed in bench, and shale, horizon of **Lower Kittanning Coal**	15	310	120'
Pottsville Series—Kanawha and New River Groups (1125')			
Sandstone, current-bedded, medium-grained, gray at bottom, coarse at top, making great cliff, **Homewood**	105	415	
Concealed, steep slope	45.7	460.7	
Sandstone and shale, sandy	19	479.7	
Shale, bluish-black, hard, sandy, micaceous, marine fossils, Orbiculoidea, **Kanawha Black Flint**	2	481.7	
Coal, gas, medium-hard...0' 8" Slate, black, with coal **streaks** ....1 2 **Coal**, semi-splint.........1 6 **Stockton**.. (No. 766 on Map II)	3.3	485	175'

	Thickness. Feet.	Total. Feet.	
Fire clay shale	3	488	
Sandstone, greenish, medium-grained, Upper **Coalburg**	42	530	
Sandstone, flaggy, and concealed	47	577	
Concealed	3	580	
Bench, **Chilton? Coal horizon**	5	585	100'
Sandstone, flaggy	20	605	
Concealed, steep slope, mostly sandy shale..	15	620	
Slate, black cannel, on bench, Holly (Williamson?) Coal horizon	5	625	40'
Shale and concealed	5	630	
Sandstone, current-bedded, **Upper Cedar Grove?**	45	675	
Concealed	10	685	
Bench	10	695	
Concealed, steep slope	33.8	728.8	
Coal, Marpleton (Cedar Grove?) (14") (No. 942 on Map II)	1.2	730	105'
Concealed	125	855	
Slate, black	5	860	
Concealed	55	915	
Shale, bluish-gray, sandy, flaggy and laminated, to horizon of top of Centralia Well (953' L.)	15	930	200'
Continued with Log of Centralia Well (No. 109F on Map II):			
Conductor	40	970	
Gravel	20	990	
Coal, Gilbert?	3	993	63'
Fire clay and slate	32	1025	32'
Sand, white, hard, fine-grained, **Nuttall?**	85	1110	
Coal, Hughes Ferry?	7	1117	92'
Slate	5	1122	
Limestone, hard	12	1134	
Shale and fire clay	56	1190	
Coal, Sewell "B"	5	1195	78'
Slate and lime	10	1205	
Shale and lime	37	1242	
Coal, Sewell	5	1247	52'
Fire clay and shale	36	1283	
Sand, white and hard, (showing of oil)	92	1375	
Shale, white and hard	60	1435	188'
Mauch Chunk Series (455')			
Shale, red, and impure lime beds	135	1570	
Lime and hard shale	90	1660	
Fire clay and limy beds	22	1682	
Lime, red shale, and fire clay	80	1762	
Sand, white- and black-grained, very hard...	56	1818	
Shale, red, lime, and black slate, or Pencil Cave	72	1890	455'
Greenbrier Limestone (100')			
Big Lime	100	1990	100'
Pocono Sandstones (430')			
Sand, Big Injun (oil at 1065')	195	2185	
Shale, dark and fine-grained	50	2235	

	Thickness. Feet.	Total. Feet.	
Sand	40	2275	
Slate, black, and hard shale	45	2320	
Slate, soft, and thin shales	35	2355	
Rock, hard, coarse, and pebbly	10	2365	
Slate, black	15	2380	
Slate and limy shale	20	2400	
Rock, hard and gritty, **Berea?**	20	2420	430'
Catskill Series (572')			
Slate	12	2432	
Sand, dark-red, very hard, **Berea?**	20	2452	
Slate, black, and hard shale	68	2520	
Red rock, hard	12	2532	
Slate	11	2543	
Slate, very soft	37	2580	
Shell, very hard	2	2582	
Slate and shale	28	2610	190'
Sand, coarse and pebbly, **Gordon**	28	2638	
Shale, very hard on bits	42	2680	
Slate, with a few hard shales	100	2780	170'
Sand, dark-blue and coarse, **Fifth**	10	2790	
Slate and shales	180	2970	
Sand, dark and pebbly, **Bayard**	22	2992	212'
Chemung Series (956')			
Slate and hard shales	88	3080	
Shale, hard and fine-grained	30	3110	
Shale, with soft streaks	440	3550	
Slate and shales, some very hard shales	340	3890	
Unrecorded to bottom	58	3948	956'

Across the County Line in the edge of Webster, the following section, measured with aneroid by C. McC. Lemley, Assistant Engineer of the Baltimore and Ohio Railroad, southwestward down the north hillside of Elk River, 0.5 mile northwest of the mouth of Gulf Branch, and kindly furnished the Survey by W. T. Diggins of Centralia, contains much data of interest, as the coal 70 feet above the base appears to represent the Sewell of the New River region, and seems to be the same bed as that 1242 feet from the top in the foregoing section. The writer visited this locality during 1915, the correlations in the section as it stands being the result of this visit, although only the basal 400 feet of measures were examined:

Section 3.5 Miles East of Centralia, Webster County.

	Thickness. Ft.	In.	Total. Ft.	In.	
Conemaugh and Allegheny Series (410')					
Unrecorded	79	0	79	0	
Coal blossom, Mahoning	1	0	80	0	80'
Unrecorded	170	0	250	0	
Coal blossom, Lower Freeport			250	0	170'

	Thickness. Ft.	In.	Total. Ft.	In.	
Unrecorded	155	4	405	4	
Coal, Lower Kittanning	4	8	410	0	160′
Pottsville Series (900′)					
Unrecorded	268	0	678	0	
Coal, Winifrede	2	0	680	0	270′
Unrecorded	229	2	909	2	
Coal blossom, No. 2 Gas	0	10	910	0	230′
Unrecorded	139	2	1049	2	
Coal, Little Eagle	0	10	1050	0	140′
Unrecorded	60	0	1110	0	
Coal, Gilbert?	...	..	1110	0	60′
Unrecorded	80	0	1190	0	
Coal ....3′ 0″ Unrecorded .....4 10 **Coal** ....2 2 } **"Twin Seam" Sewell "B"?**	10	0	1200	0	90′
Unrecorded	34	10	1234	10	
Coal, soft, columnar, **Sewell** (1065′ B.)	5	2	1240	0	40′
Unrecorded to Elk River	70	0	1310	0	70′

In the same County, slightly over 2 miles southeast of the Braxton Line, the writer measured the following section with aneroid from the summit of a knob, 1 mile northwest of Erbacon, eastward mostly along the hill road to the road fork 0.4 mile northwest of the railway station at the latter town. That portion above the base of the Allegheny Series was determined approximately on the strike of the rocks, but that in the Pottsville, on the rapid southeast rise of the strata; hence, in the latter formation, the results are less than they should be. The coal at 738 feet from the top had been mined locally for domestic fuel near the road fork in question, and appears to represent the Campbell Creek (No. 2 Gas) bed:

Section 0.5 Mile Northwest of Erbacon, Holly District, Webster County.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (40′)			
Concealed and sandstone, grayish-white, from summit of knob, **Lower Mahoning**	40	40	40′
Allegheny Series (315′)			
Coal blossom, Upper Freeport (2245′ B.)	...	40	
Concealed	20	60	
Sandstone, massive, grayish-white, pebbly, **Upper Freeport**	20	80	
Concealed	25	105	65′
Sandstone, grayish-white, platy, **Lower Freeport**	60	165	

	Thickness. Feet.	Total. Feet.	
Concealed to spring, **Upper Kittanning Coal horizon**	10	175	70'
Sandstone, grayish-white, massive, to current-bedded, **Upper East Lynn**	65	240	
Concealed	15	255	
Sandstone, platy, current-bedded, grayish-white, hard, **East Lynn**	40	295	
Concealed and sandstone, platy	30	325	
Concealed and shale	15	340	
Coal blossom, heavy, "No. 5 Block," Lower Kittanning	5	345	170'
Concealed	10	355	
Coal blossom, Clarion	...	355	10'
Pottsville Series—Kanawha Group (425')			
Concealed	44.5	399.5	
Iron ore, shaly	0.5	400	
Sandstone, coarse, brown	25	425	
Concealed	15	440	
Sandstone, coarse, massive	20	460	
Concealed, mostly sandstone	30	490	
Concealed	30	520	
Shale, sandy	5	525	
Coal (1")	...	525	170'
Fire clay shale and concealed	5	530	
Sandstone, grayish-white, highly siliceous	25	555	
Concealed	35	590	
Coal digging, thickness concealed, evidently not much found from debris, **Chilton?**	...	590	65'
Concealed	30	620	
Spring, sulphurous	...	620	
Concealed and sandstone	116	736	
Shale, sandy	2	738	
Coal, soft 1' 0" Shale, gray 0 2 **Coal**, medium-hard 0 10 **No. 2 Gas?** (1555' B.)	2	740	150'
Shale, sandy	5	745	
Concealed	20	765	
Shale, sandy, to road forks on Missouri Creek	15	780	40'

The following section was measured with aneroid by Gawthrop in the southwestern point of Holly District, Braxton County, southeastward along a ravine on the west hillside of Carpenter Fork of Little Birch. The intervals are somewhat less than they should be, due to the rapid rise of the strata in the direction the determinations were made. The interval between the Lower Kittanning Coal and the bed at the base of the section—correlated with the Stockton—is probably about 100 feet, or 50 feet less than shown in the Palmer Section on a preceding page of this Chapter:

Section 1.3 Miles Southeast of Little Birch, Holly District.

		Thickness. Feet.	Total. Feet.	
Allegheny Series (125')				
Sandstone, massive, gray, medium-grained, making cliff, **Upper East Lynn**		25	25	
Concealed		70	95	
Shale, brown		9	104	
Coal, gas, (11"), Middle Kittanning		1	105	105'
Concealed		8	113	
Shale		2	115	
Slate, coal streaks		2	117	
Coal, splint 1' 6" Slate 0 1 **Coal, gas** 0 9 Shale, dark-gray 2 6 **Coal, semi-splint** 1 2 **Coal, splint** 2 0	**"No. 5 Block"** (No. 595 on Map II)	8	125	20'
Pottsville Series—Kanawha Group (74.6')				
Shale and concealed		60	185	
Shale, brownish-gray		10	195	
Coal, medium-hard, gas 1' 0" Shale, gray 0 9 **Coal, splint** 2 10	**Stockton?** (1320' B.) (No. 769 on Map II)	4.6	199.6	74.6'
Shale and concealed				

CLAY COUNTY SECTIONS.

Otter District.

Otter District occupies the northern point of Clay County and its surface rocks belong exclusively in the Monongahela, Conemaugh, and Allegheny Series. In the northwest edge, the following section was measured with aneroid by the writer northward along the hill road from the summit of a knob:

Section 1.5 Miles Southwest of Nebo, Otter District.

		Thickness Feet.	Total. Feet.	
Monongahela Series (185')				
Sandstone, coarse, brown, pebbly 10' Shale, brown, concealed, and shale 25 Sandstone 20	**Upper Sewickley Sandstone**	55	55	
Concealed		10	65	
Shale and concealed		45	110	
Bench, narrow, flat		5	115	
Concealed, steep slope		50	165	
Bench, slight, and concealed, **Pittsburgh** (1160' B.)		20	185	185'

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (110')			
Shale, red	25	210	
Sandstone, **Lower Pittsburgh**, to bench	50	260	75'
Shale	25	285	
Concealed (1050' B.)	10	295	35'

Two miles southeastward in the same District, the following succession is obtained by combining a section measured with aneroid by the writer northeastward from the summit of the high knob 0.8 mile south of Big Otter P. O., with the log of the J. M. Boggs No. 1 Well—No. 111 on Map II—the details of which were kindly furnished the Survey by Mr. C. T. Underwood of Ivydale. That portion above the well mouth was determined closely along the strike of the strata. The well in question was completed in April, 1911, and was a light gasser from the Big Injun Sand, and in October, 1915, was still supplying domestic fuel for 18 families in the immediate neighborhood:

Section 0.5 Mile Southeast of Big Otter, Otter District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (220')			
Sandstone, coarse, brown, pebbly, from summit of knob, **Upper Sewickley**	60	60	
Concealed	15	75	
Sandstone, **Lower Sewickley**, green, micaceous, medium-grained, partly concealed, making steep slope	50	125	
Concealed, mostly shale, brown, in steep slope	25	150	
Concealed, steep slope	60	210	
Concealed, bench	6.5	216.5	
Coal opening, Pittsburgh, on land of J. M. Boggs (Opening No. 223 on Map II) (1322' L.)	3.5	220	220
Conemaugh Series (605')			
Shale, sandy	5	225	
Sandstone, conglomeratic in middle portion, **Lower Pittsburgh**	70	295	
Bench, with red shale	30	325	
Sandstone, forms steep slope, **Connellsville**	40	365	145
Concealed in gentle slope, mostly red shale	100	465	
Sandstone, coarse, brown, forming bluff, partly concealed, **Grafton**	55	520	
Concealed	10	530	165
Sandstone, green, micaceous, broken, forming steep bluff, **Jane Lew**	40	570	

	Thickness. Feet.	Total. Feet.	
Bench, concealed	5	575	
Sandstone, green, micaceous, broken, forming steep bluff, **Saltsburg**	65	640	
Bench, **Bakerstown Coal horizon**	5	645	115'
Concealed, gentle slope	20	665	
Sandstone, forming steep bluff, **Buffalo** (840' B.)	40	705	60'
Continued with Log of J. M. Boggs No. 1 Well (No. 111 on Map II):			
Unrecorded	34	739	
Slate	86	825	120
Allegheny Series (258')			
Sandstone ....30' Slate ....10 Sandstone ....35 } **Upper Freeport Sandstone**	75	900	
Slate	10	910	
Sandstone	5	915	
Slate	58	973	148'
Sandstone, **Upper East Lynn**	104	1077	
Coal, No. 5 Block	2	1079	106'
Slate	4	1083	4'
Pottsville Series (1106')			
Sandstone, **Homewood**	82	1165	
Coal, Stockton	1	1166	83'
Slate	53	1219	
Sandstone	16	1235	
Slate	80	1315	
Sandstone	16	1331	
Slate	6	1337	
Lime	28	1365	
Slate	30	1395	
Lime shells	170	1565	
Sandstone	30	1595	
Lime	70	1665	
Sandstone	76	1741	
Slate	96	1837	
Sandstone	74	1911	
Lime	29	1940	
Sandstone	60	2000	
Slate	8	2008	
Lime	27	2035	
Sand, Salt (black oil, show at 1385' depth)	154	2189	1023'
Mauch Chunk Series (150')			
Lime	11	2200	
Red rock	20	2220	
Lime	10	2230	
Sand, Maxton	84	2314	
Slate	5	2319	
Sand	5	2324	
Pencil Cave	15	2339	150'
Greenbrier Limestone (126')			
Big Lime, (gas show, 1697-1700'; and oil, amber, show, 1700-1705')	126	2465	126'

	Thickness. Feet.	Total. Feet.	
Pocono Sandstone Series (400')			
Sand, white, **Big Injun**, (gas at 1780-1785', sufficient for domestic fuel for several families)	32	2497	
Slate and shells	368	2865	400'
Catskill Series (296')			
Slate and shells to bottom of hole	296	3161	296'
10" casing, 40'; 8¼", 580'; 6⅝", 1630'.			

In the southeast corner of Otter District (Clay), the writer measured with aneroid the following section southwestward down the steep point to the mouth of O'Brien Creek. It is important, in that the true position of the horizon of the locally famous "O'Brien Creek" Coal is shown with reference to the great Upper Freeport Sandstone, the latter being a very persistent "key-rock" along the valley walls of Elk below Frametown in both counties:

Section at Mouth of O'Brien Creek, Otter District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (300')			
Sandstone, massive, coarse, brown, conglomeratic, making great cliff, large quartz pebbles, **Upper Freeport**	75	75	
Concealed, steep slope	10	85	
Bench, **Lower Freeport Coal horizon**	15	100	100'
Concealed, mostly sandstone	45	145	
Bench, **Upper Kittanning, "O'Brien Creek" Coal horizon** (920' B.)	10	155	55'
Sandstone, grayish-white, conglomeratic, making cliff, **Upper East Lynn**	50	205	
Concealed	5	210	
Bench, fire clay visible, mostly concealed, **Middle Kittanning Coal horizon**	10	220	65'
Sandstone, grayish-white, current-bedded, coal spars at base, making cliff, **East Lynn**	74	294	
Coal, **Lower Kittanning, "No. 5 Block,"** (780' B.)	1	295	75'
Shale and concealed	5	300	
Pottsville Series (15')			
Sandstone, current-bedded, to mouth of O'Brien Creek (760' B.)	15	315	20'

One and a half miles southwestward in the southern border of the same District, Gawthrop measured the following section with aneroid down the north hillside of Elk River opposite the mouth of Jumping Gut. The coal at 290 feet from the top—correlated with the Lower Kittanning—undoubtedly represents the "No. 5 Block" bed of Widen, Clay County, and of Montgomery, Fayette County:

Section 0.6 Mile Southwest of Groves, Buffalo District.

		Thickness. Feet.	Total. Feet.	
Allegheny Series (297.5')				
Concealed and sandstone, massive, brown, coarse-grained, pebbly, **Upper Freeport**		40	40	
Concealed to bench		20	60	
Concealed		50	110	
Sandstone, massive, gray, partly concealed		85	195	
Sandstone, massive, brownish-gray, very pebbly at top, **Upper East Lynn**		25	220	
Concealed		10	230	230'
Sandstone, partly concealed .50'	**East Lynn**	60	290	
Sandstone, massive, gray, hard .10				
Coal .0' 3"	**"No. 5 Block"** (830' B.)	5.5	295.5	65.5'
Shale, gray .0 4				
Coal .0 2				
Slate, coaly .2 0				
Coal .0 5				
Shale .0 2				
Coal, hard, splinty .2 2				
Shale and concealed		2	297.5	
Pottsville Series (72.5')				
Sandstone		22.5	320	
Concealed to Elk River		50	370	74.5

In the southwest corner of the same District, the writer measured the following section with aneroid down the steep north hillside of Elk at Ivydale, ¼ mile below the highway bridge over the river:

Ivydale Section, Otter District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (40')			
Concealed from summit of knob	40	40	40'
Allegheny Series (272')			
Sandstone, coarse, brown, friable, **Upper Freeport**	35	75	
Concealed and sandy shale, brown	15	90	
Sandstone, green, micaceous	20	110	
Shale, green, sandy, with thin sandstones	55	165	
Concealed, **Upper Kittanning Coal horizon** (980' B.)	7	172	132'
Fire clay shale	5	177	

	Thickness. Feet.	Total. Feet.	
Shale, green, sandy	8	185	
Sandstone, massive, coarse, brown, pebbly, **Upper East Lynn**	77	262	90'
Shale, sandy, with iron ore lenses	3	265	
Sandstone, massive, making great cliff, **East Lynn**	25	290	28
Shale, bluish-gray, iron ore nodules abundant, **"No. 5 Block" Coal horizon**	5	295	
Shale, sandy	10	305	
Sandstone, shaly, iron ore nodules	5	310	
Concealed and shale	2	312	
Pottsville Series—Kanawha Group (118')			
Sandstone, grayish-white, making cliff, **Homewood**	23	335	
Concealed to Elk River (725' B.)	90	425	
Coal, Stockton, reported 5' thick in bed of Elk at mouth of Two Run, not seen	5	430	140'

Buffalo District (Clay) Sections.

Buffalo District lies in the eastern portion of Clay County, immediately southeast of the area last discussed and its surface rocks belong in the Conemaugh, Allegheny, and Pottsville Series exclusively. In its northern edge, the following section was measured with aneroid by the writer northeastward on the south hillside of Elk River from the summit of the high knob 0.4 mile due south of the mouth of Jumping Gut at the fine cliff exposures, locally known by old rivermen as the "End of the World". Important details of both the Allegheny and Pottsville are shown. The great conglomerate at the top undoubtedly represents the Upper Freeport Sandstone, so that almost the whole of the former series is present:

Section 1 Mile Southwest of Groves, Buffalo District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (330')			
Sandstone, massive, current-bedded, conglomeratic, making great cliff, capping knob, **Upper Freeport**	85	85	
Shale, sandy	5	90	
Concealed, mostly sandstone, **Lower Freeport**	45	135	
Concealed, bench	10	145	
Sandstone, coarse, brown, making cliff	10	155	
Coal blossom, thickness concealed, **Upper Kittanning**	5	160	160'

	Thickness. Feet.	Total. Feet.	
Sandstone, grayish-white, conglomeratic, large quartz pebbles in base, making great cliff, Upper East Lynn	80	240	
Shale, sandy	5	245	85'
Sandstone, grayish-white, making great cliff, East Lynn	72	317	
Concealed	5	322	
Coal, slaty.1' 6" Coal, gray splint ..1 6' } "No. 5 Block," Lower Kittanning (845' B.)	3	325	80'
Shale	5	330	
Pottsville Series (85')			
Sandstone, grayish-white, iron ore nodules at base, making cliff, Homewood	30	360	
Shale	5	365	
Concealed and shale	4	369	
Coal, Stockton "A" (800' B.)	1	370	45'
Shale, flaggy and sandy	10	380	
Concealed to Coal & Coke Ry. grade (785' B.)	5	385	
Concealed to Elk River	30	415	45'

Slightly less than 2½ miles northeastward in the same District, the writer measured with aneroid the following section southwestward down a point to Elk River, 0.5 mile above the mouth of Frame Run:

Section 1.3 Miles South of Villa Nova, Buffalo District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (315')			
Bench, Upper Freeport Coal horizon	10	10	
Sandstone, grayish-white, brown, massive, conglomeratic, large quartz pebbles, making cliff, Upper Freeport	75	85	
Bench, flat, Lower Freeport Coal horizon	10	95	
Sandstone, greenish-brown, and concealed	50	145	
Bench, Upper Kittanning Coal horizon	10	155	155'
Sandstone, grayish-white, conglomeratic, Upper East Lynn	55	210	
Concealed, bench	15	225	70'
Sandstone, grayish-white, current-bedded, conglomeratic, East Lynn, to Coal and Coke Ry. grade, (795' B.)	55	280	
Concealed to Elk River	35	315	90'

In the same District, the writer measured the following section northeastward on the west hillside of Groves Creek:

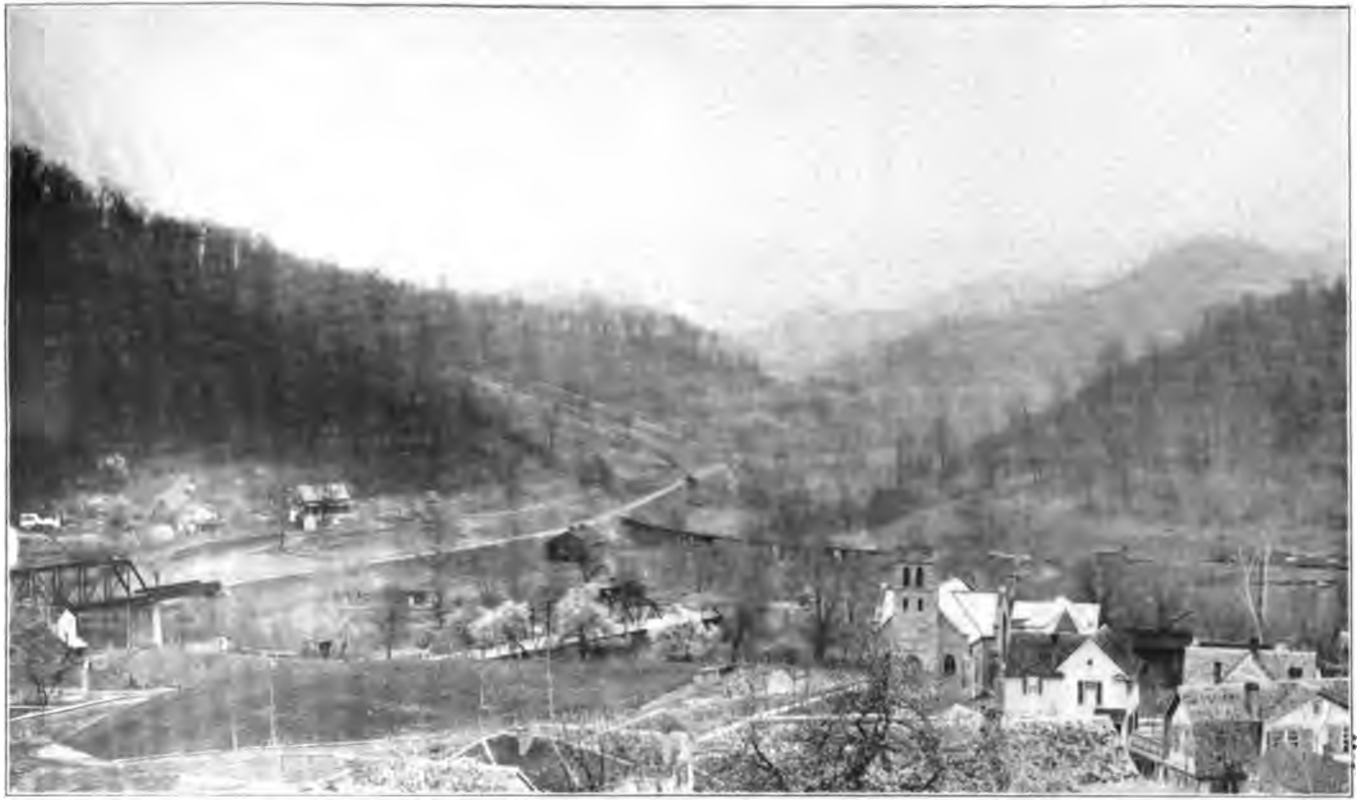

PLATE V.—Looking northeastward up Little Otter Creek from Gassaway, showing topography of Monongahela and Conemaugh Series, and sandstone quarry in Morgantown ledge, left margin.

Section 1.2 Miles Southeast of Groves, Buffalo District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (320')			
Sandstone, conglomeratic, making cliff, large quartz pebbles, **Upper Freeport**	95	95	
Bench, **Lower Freeport Coal horizon**	5	100	
Concealed, steep slope	50	150	
Concealed in bench	2.5	152.5	
Coal opening, T. J. Young, (reported 30"), **Upper Kittanning** (980' B.)	2.5	155	155'
Concealed, steep slope	69	224	
Coal, reported at digging (12"), **Middle Kittanning**	1	225	70'
Sandstone, grayish-white, current-bedded, making great cliff, **East Lynn**	65	290	
Concealed	20	310	
Sandstone, grayish-white, to bed of Groves Creek	10	320	95'

Two and a half miles southwestward in Buffalo District, the following section was measured with aneroid by the writer eastward along the hill road to the bed of Flat Fork:

Section ¼ Mile West of Harrison, Buffalo District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (105')			
Concealed from road summit, trail fork	10	10	
Shale, pale-red	5	15	
Sandstone, coarse, brown	20	35	
Concealed and fire clay shale	5	40	
Shale, pale-red	5	45	
Concealed and sandstone	45	90	
Bench	15	105	105'
Allegheny Series (165')			
Sandstone, coarse-grained, brown, conglomeratic, large quartz pebbles, middle portion concealed, **Upper Freeport**	115	220	
Shale, in bench, **Lower Freeport Coal horizon**, (1115' B.)	5	225	
Concealed to bed of Flat Fork, 0.2 mile west of Harrison	45	270	165'

Slightly over a mile and a half due east of Harrison in the same District, the writer measured with aneroid the following section northeastward along a point on the west hillside of Groves Creek to a closed digging in what appears to be the Middle Kittanning Coal. The results are slightly greater than they should be owing to the northward dip of the strata here:

Section 1.6 Miles Due East of Harrison, Buffalo District.

Allegheny Series (255')	Thickness. Feet.	Total. Feet.	
Sandstone, grayish-white, conglomeratic, large quartz pebbles, making cliff, **Upper Freeport**	75	75	
Concealed	10	85	
Bench, **Lower Freeport Coal horizon**	5	90	90'
Concealed	20	110	
Bench, slight	5	115	
Concealed, steep slope	65	180	
Coal, at digging, **Upper Kittanning**, thickness concealed (No. 443 on Map II)	...	180	90'
Bench	5	185	
Sandstone, grayish-white, conglomeratic, large quartz pebbles in upper portion, **Upper East Lynn**	60	245	
Concealed and **Coal, Middle Kittanning**, at Opening No. 531 on Map II (975' B.) on north bank of Groves Creek, thickness concealed	10	255	75'

One-half mile northeastward in Buffalo District, Gawthrop measured the following section with aneroid southwestward along a ravine on the north side of Root Fork to a coal digging near the bed of the latter, 0.2 mile above the mouth of the fork:

Root Fork of Groves Creek Section, Buffalo District.

Allegheny Series (197.8')	Thickness. Feet.	Total. Feet.	
Concealed and sandstone, massive, brown, pebbly, **Upper Freeport**	20	20	
Concealed	60	80	
Bench, slight, **Lower Freeport Coal horizon**	...	80	
Concealed	50	130	
Bench, broad, **Upper Kittanning Coal horizon**	...	130	130'
Sandstone, massive, gray, hard, partly concealed, **Upper East Lynn**	65	195	
Coal, blocky, semi-splint ....0' 6" **Coal**, slaty.......0 3 **Coay**, blocky, gas.0 3 **Coal**, semi-splint..1 10 **Middle Kittanning** (950' B.) (2' 10")	2.8	197.8	67.8'
Concealed			

In the same District, Gawthrop measured with aneroid the following section southward on the north hillside of Plum

Run to a coal digging on the north bank of the latter, 0.4 mile up from the mouth of the same stream:

Plum Run of Groves Creek Section, Buffalo District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (175')			
Concealed	25	25	
Sandstone, massive, brown	5	30	
Concealed	20	50	
Sandstone, massive, brownish-gray, pebbly	10	60	
Concealed	50	110	
Bench, Upper Kittanning Coal horizon	...	110	110'
Concealed, steep slope	50	160	
Sandstone	5	165	
Sandstone, dark	3	168	
Slate	0.5	168.5	
Coal ....0' 2" Shale, hard, sandy....0 8 **Coal** ....0 5 Middle Kittanning... (910' B.) (1' 3")	1.3	169.8	59.8'
Concealed	5.2	175	5.2'

In the extreme eastern point of Buffalo District, Clay County, the following succession is obtained by combining a section measured with aneroid from the summit of the high knob on the Clay-Nicholas County Line northeastward on the west hillside of Road Fork of Strange Creek via an opening in the "No. 5 Block" (Lower Kittanning) Coal bed, with the log of the J. D. Cameron No. 2 Well (No. 116 on Map II, located in Nicholas County on the north bank of Road Fork, 1.3 miles southeast of Dille). The well in question was completed in October, 1910, by the Hope Natural Gas Company and its record kindly furnished the Survey by the United Fuel Gas Company of Charleston, West Virginia, no showing of either oil or gas being reported:

Section 3 Miles Northeast of Widen, Buffalo District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (60')			
Concealed, mostly sandstone, in steep slope from summit of knob in County Line	60	60	60'
Allegheny Series (340')			
Bench, Upper Freeport Coal horizon (1690' B.)	5	65	
Sandstone, coarse-grained, brown, conglomeratic, Upper Freeport	85	150	
Bench, slight, Lower Freeport Coal horizon	10	160	100'

	Thickness. Feet.	Total. Feet.	
Concealed, steep slope, and sandstone, **Lower Freeport**	60	220	
Bench, flat, **Upper Kittanning Coal horizon**	10	230	70'
Concealed, mostly sandstone, in steep slope	90	320	
Bench, **Middle Kittanning Coal horizon**	5	325	95'
Sandstone, grayish-white, making cliff, not pebbly, concealed, **East Lynn**	69	394	
Coal, "No. 5 Block," Lower Kittanning (No. 640 on Map II) (1360' B.)	6	400	75'
Pottsville Series (1285')			
Concealed to top of J. D. Cameron Well (116 on Map II)	40	440	
Continued with Log of J. D. Cameron No. 2 Well:			
Conductor	16	456	
Unrecorded	14	470	
Sandstone	40	510	
Slate	50	560	
Sandstone	12	572	
Slate	10	582	
Sand, **Upper Coalburg**	18	600	
Coal, Coalburg	6	606	206'
Slate	57	663	
Sand, **Lower Coalburg**	6	669	
Lime	11	680	
Sand, **Upper Winifrede**	25	705	
Slate	10	715	
Coal, Winifrede	7	722	116'
Slate	8	730	
Sand, **Lower Winifrede**	20	750	
Slate	70	820	
Lime	28	848	
Sand	22	870	
Slate	10	880	
Lime	32	912	
Slate	28	940	
Lime	30	970	
Slate	20	990	
Lime	10	1000	
Sand	15	1015	
Slate	27	1042	
Sand	28	1070	
Lime	25	1095	
Sand	33	1128	
Slate	19	1147	
Lime	103	1250	
Sand	40	1290	
Slate	25	1315	
Sand	35	1350	
Lime	90	1440	
Sand	35	1475	
Lime	35	1510	
Slate	50	1560	
Sand	80	1640	
Slate	25	1665	
Sand	20	1685	963'

	Thickness. Feet.	Total. Feet	
Mauch Chunk Series (370')			
Lime	27	1712	
Red rock	188	1900	
Slate	30	1930	
Lime	40	1970	
Red rock	30	2000	
Sand, Maxton	55	2055	370'
Greenbrier Limestone (85')			
Big Lime	85	2140	85'
Pocono Sandstones (109')			
Sand, Big Injun, to bottom of hole	109	2249	109'

Slightly less than three miles southwestward, in the edge of the same District, the writer measured with aneroid the following section from the summit of a high knob on the Clay-Nicholas Line, northeastward along the strike to the bed of a branch of Buffalo Creek, 0.6 mile southeast of the mouth of Brushy Fence Fork. The great Upper Freeport Sandstone is present in typical development for the territory of this Report, the horizon of the No. 5 Block Coal—mined commercially at Widen, Clay County—being correctly placed:

Section 1 Mile Southeast of Widen, Buffalo District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (85')			
Concealed and sandstone, coarse, brown	35	35	
Bench	5	40	
Concealed, steep slope, mostly sandstone	45	85	85'
Allegheny Series (355')			
Bench	5	90	
Sandstone, massive, coarse-grained, brown, conglomeratic, large blue and white quartz pebbles abundant, Upper Freeport	100	190	
Bench, gentle slope	20	210	
Sandstone, concealed, but forms steep slope, Lower Freeport	40	250	
Bench, Upper Kittanning Coal horizon	10	260	175'
Concealed, steep slope	30	290	
Bench, Middle Kittanning Coal horizon	10	300	40'
Sandstone, grayish-white, hard, current-bedded, Upper East Lynn	40	340	
Concealed, steep slope, mostly sandstone, grayish-white	95	435	
Bench and stake on outcrop of No. 5 Block Coal (1380' B.)	5	440	140'
Pottsville Series—Kanawha Group (110')			
Concealed, steep slope, to bed of creek	110	550	110'

The following section was measured with aneroid by the writer mostly along a trail from the summit of a high knob, 0.8 mile due north of Widen, to the bed of Buffalo Creek about 200 yards below the railway station at Widen. The intervals are slightly less than they should be, due to the northwest dip of the strata:

Section at North Edge of Widen, Buffalo District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (125')			
Sandstone, coarse, brown, capping knob, concealed, and shale	125	125	125'
Allegheny Series (325')			
Sandstone, coarse, brown, conglomeratic, large quartz pebbles, **Upper Freeport**	85	210	
Bench, slight, **Lower Freeport Coal horizon**	10	220	
Concealed, with iron ore nodules	20	240	
Sandstone, greenish-gray, medium-grained	35	275	
Bench, **Upper Kittanning Coal horizon**	10	285	160'
Sandstone, grayish-white, making cliff, **Upper East Lynn**	75	360	
Concealed, steep slope	84.2	444.2	
Coal, "No. 5 Block" (No. 651 on Map II) (1298' L.)	5.8	450	165'
Pottsville Series—Kanawha Group (200')			
Concealed, steep slope	110	560	
Concealed	25	585	
Sandstone	20	605	
Shale	3	608	
Cannel slate.........0' 4" **Coal**.........0 4 Slate, black.........0 0½ **Coal**.........1 7½ **Coalburg**.... (1150' B.)	2.3	610.3	160.3'
Slate and concealed to Buffalo Creek, Club House at Widen	39.7	650	39.7'

Four miles southwestward in the same District, Gawthrop measured with aneroid the following section northeastward along the hill road on the head of Cow Run:

Section ¾ Mile Southeast of Eakle, Buffalo District.

	Thickness. Feet.	Total. Feet.
Allegheny Series (315')		
Iron ore nodules, **Upper Freeport Coal horizon**	1	1
Shale, sandstone and concealed	85	86
Bench, **Lower Freeport Coal horizon**	...	86
Concealed	80	166

	Thickness. Feet.	Total. Feet.	
Bench, **Upper Kittanning Coal horizon** (1475′ B.)	...	166	166′
Concealed	10	176	
Sandstone, **Upper East Lynn**	10	186	
Concealed	100	286	
Sandstone, massive, gray	10	296	
Coal, gas, hard, **Middle Kittanning**, (1340′ B.)	1.7	297.7	
Slate and concealed	12.3	310	
Sandstone	5	315	
Coal, splint, 6″ visible, "**No. 5 Block**," (1325′ B.)	...	315	149′

In the southwest edge of the same District, the writer measured with aneroid the following section from the summit of a high knob southwestward along the strike of the strata to the bed of Buffalo Creek at the mouth of Dog Run. The position of the Coalburg Coal horizon is correctly indicated, since less than one mile southwestward, on Wallowhole Fork, this bed is opened 20 to 30 feet below the Stockton Coal with its overlying marine fossiliferous shale, the latter representing the Kanawha Black Flint:

Cressmont Section, Buffalo District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (45′)			
Concealed from summit of knob	45	45	45′
Allegheny Series (355′)			
Sandstone, green, medium-grained, pebbly, ledge mostly concealed, **Upper Freeport**	75	120	
Bench	15	135	
Concealed, mostly sandstone, pebbles not abundant, **Lower Freeport**	75	210	
Bench, **Upper Kittanning Coal horizon**	10	220	175′
Sandstone, grayish-white, conglomeratic, platy, pebbly from base to within 30′ of top, making cliff toadstool forms on point, **Upper East Lynn**	85	305	
Sandstone, grayish-white, current-bedded, platy, **East Lynn**	90	395	
Bench, "**No. 5 Block**"—**Lower Kittanning Coal horizon**, (1060′ B.)	5	400	180′
Pottsville Series (280′)			
Sandstone, grayish-white, current-bedded, making cliff, **Homewood**	45	445	
Bench	15	460	
Sandstone, grayish-white, brown, medium-grained to coarse, making cliff, **Homewood**	45	505	

	Thickness. Feet.	Total. Feet.	
Concealed	10	515	
Bench, **Stockton Coal horizon**	5	520	120′
Concealed	20	540	
Bench, **Coalburg Coal horizon**	5	545	
Sandstone, current-bedded, broken, flaggy top, **Lower Coalburg and Upper Winifrede**	115	660	
Concealed to bed of Buffalo Creek at mouth of Dog Run (780′ B.)	20	680	160′

The following section was measured with aneroid by Gawthrop southeastward along the hill road to the bed of Sand Fork of Buffalo Creek. The coal at 490 feet from the top is undoubtedly the Coalburg, since it was traced directly up Buffalo Creek to this point from Dundon where it was once mined commercially:

Section 0.5 Mile Northeast of Sand Fork Station, Buffalo District.

Allegheny and Pottsville Series (505′)	Thickness. Feet.	Total. Feet.	
Bench	0	0	
Concealed	35	35	
Sandstone, massive, broken, and shaly	20	55	
Concealed to bench	30	85	
Concealed, with sandstone	80	165	
Bench, **Upper Kittanning Coal horizon**	...	165	165′
Sandstone, **Upper East Lynn**, massive, coarse-grained, pebbly, mostly concealed	90	255	
Bench	...	255	
Concealed	115	370	
Sandstone, massive, broken, gray, partly concealed	50	420	
Concealed	68	488	
Slate, black, siliceous, plant fossils	2	490	
Coal, slaty 0′ 3″ **Shale** 0 9 **Coal, gas** 0 4 **Shale, dark-gray** 0 5 **Slate, black** 0 5 **Coal, splint** 2 9 **Coal, splint, very hard** 0 9 **Coalburg** (815′ B.). (5′ 8″) (No. 815 on Map II)	5.7	495.7	330.7′
Concealed and sandstone to run	9.2	505	9.3′

Henry District (Clay) Sections.

Henry District extends in a northwest-southeast direction entirely across Clay County, so that its surface strata include the Monongahela, Conemaugh, Allegheny, and Pottsville Series. In the extreme northwestern edge, the following succession is obtained by combining a section measured with aneroid by the writer from the summit of the high knob 0.4 mile northwest of Wallback, southeastward, with the log of the W. C. Tallman No. 1 Well (120 on Map II, located on the west bank of Charleston Fork, 0.1 mile above the mouth of the latter). The results for the Conemaugh Series are 30 to 40 feet greater than they should be, owing to the dip of the rocks to the southeast where these measurements were determined. The driller evidently failed to record parting slates in the great arenaceous mass at 678 feet from the top, since no such thickness—422 feet—of sandstone has ever been reported on outcrop exposures in this portion of the rock column:

Wallback Section, Henry District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (20′)			
Sandstone, from top of knob	10	10	
Concealed, bench, **Pittsburgh Coal horizon**	10	20	20′
Conemaugh Series (658′)			
Sandstone, coarse, brown, pebbly base, flaggy top, **Lower Pittsburgh**	45	65	
Shale, brown	5	70	
Sandstone, coarse, brown, making great cliff, large quartz pebbles, **Connellsville**	60	130	
Bench, **Little Clarksburg Coal horizon**	5	135	
Sandstone, platy, flaggy, fine-grained, **Lower Connellsville**	95	230	
Bench	5	235	
Sandstone, **Morgantown**	70	305	
Bench	5	310	290′
Concealed, gentle bench, mostly red shale	45	355	
Sandstone, green, micaceous, fine-grained, **Grafton**	35	390	
Concealed	55	445	
Sandstone, green, **Saltsburg**	45	490	180′
Concealed, gentle slope	35	525	
Sandstone, green, micaceous, fine-grained ....20′ Concealed, slight bench........15 Sandstone, massive, medium-grained, greenish-gray......30 **Buffalo**	65	590	

	Thickness. Feet.	Total. Feet.	
Concealed and shale	10	600	
Sandstone, massive, coarse, brown, Upper Mahoning, (780′ B.)	40	640	
Shale	4	644	
Coal, Mahoning	1	645	155′
Concealed, to top of W. C. Tallman Well (120 on Map II)	15	660	
Continued with Log of W. C. Tallman Well:			
Surface	18	678	33′
Allegheny and Pottsville Series (1382′)			
Sand	422	1100	
Coal, Coalburg	10	1110	432′
Sand	75	1185	
Coal, Winifrede	6	1191	81′
Sand	69	1260	
Slate	20	1280	
Sand	25	1305	
Slate and limestone	300	1605	
Sand	55	1660	
Limestone and slate	106	1766	
Salt Sand	294	2060	569′
Mauch Chunk Series (140′)			
Slate and lime	85	2145	
Red rock	10	2155	
Little Lime	35	2190	
Pencil Cave	10	2200	140′
Greenbrier Limestone (130′)			
Big Lime (three breaks in Big Lime, all caved)	130	2330	130′
Pocono Sandstones and Devonian (1331′)			
Big Injun Sand (some gas)	6	2336	
Lime	54	2390	
Slate	108	2498	
Lime	52	2550	
Slate and hard shells	510	3060	
Sand, Gordon (Fifth Sand)	25	3085	
Slate and shells to bottom	576	3661	1331′

Conductor, 18′; 10″ casing, 30′; 8¼″ casing, 560′; 6⅝″ casing, 1603′; well completed, May 20, 1901.

The foregoing section is a revision of that published for the same region on pages 96-7 of the Wirt-Roane-Calhoun Report of the State Geological Survey, where, owing to reasons given on pages 30-31 in Chapter III of this Report, the horizon of the Pittsburgh Coal was placed about 200 feet too low in the measures.

Two and a half miles due southward in the same District, the writer measured the following section with aneroid northeastward from the summit of Pilot Knob to the low gap at the head of Charleston Fork and thence along the hill road on the head of the latter stream:

Pilot Knob Section, Henry District.

	Thickness. Feet.	Total. Feet.	
Monongahela Series (165')			
Sandstone, green, micaceous	5	5	
Shale	10	15	
Sandstone, brown, flaggy, with shale layers, brown, **Cedarville**	75	90	
Sandstone, greenish-gray, medium-grained, micaceous, making cliff, **Upper Pittsburgh**	55	145	
Concealed, steep slope	15	160	
Bench, **Pittsburgh Coal horizon**	5	165	165'
Conemaugh Series (505')			
Concealed in steep slope, mostly coarse pebbles	90	255	
Sandstone, medium-coarse, brown, **Connellsville**	45	300	135'
Bench, concealed	10	310	
Sandstone, green, micaceous, **Lower Connellsville**	35	345	
Concealed in gentle slope, and red shale	15	360	
Sandstone, **Morgantown**, green, micaceous, making steep bluff 40' to 60' high	60	420	
Concealed and red shale with iron ore	20	440	
Sandstone, green, micaceous, **Grafton**	20	460	160'
Concealed and red shale to road fork, low gap, (1104' L.)	40	500	
Concealed and red shale, northwest along hill road	45	545	
Sandstone and concealed	5	550	
Shale, red, sandy	25	575	
Sandstone, green, micaceous, shaly, **Buffalo**	23	598	138'
Shale	2	600	
Fire clay shale, dark, **horizon of Brush Creek Coal**	10	610	
Concealed	15	625	
Shale, gray and reddish	20	645	
Sandstone, **Lower Mahoning**, (950' B.)	25	670	72'

Slightly less than 2½ miles southwestward in the same District, the writer measured with aneroid the following section eastward on the west hillside of Summers Fork of Laurel Creek, ¼ mile above the mouth of the former:

Section 1.5 Miles Southeast of Barton, Henry District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (40')			
Concealed, steep slope	40	40	40'
Allegheny Series (245')			
Bench	5	45	
Sandstone, conglomeratic, **Upper Freeport**, and concealed	175	220	180'
Sandstone, grayish-white, medium-grained, micaceous, **Upper East Lynn**	28	248	
Shale, bluish-gray, sandy, plant fossils	5.3	253.3	
Coal opening, Middle Kittanning, on land of Hannah Wyant (No. 532 on Map II), (800' B.)	1.7	255	35'
Shale, gray	5	260	
Sandstone, grayish-white, **East Lynn**, to bed of Summers Fork	25	285	30'

About 2 miles eastward, the following succession is obtained by combining a section measured with aneroid northward along the hill road immediately southeast of the mouth of Hansford Fork of Laurel, with the log of the J. M. Gross No. 1 Well (121 on Map II, located on the west bank of the latter, opposite the mouth of the former), the details of which were published on pages 473-4 of Volume I(a) of the State Geological Survey Reports. The results above the well mouth are greater than they should be, owing to the rapid northwest dip of the strata:

Section 1 Mile Southwest of Valley Fork P. O., Henry District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (50')			
Concealed and shale from summit at road forks	50	50	50'
Allegheny Series (405')			
Sandstone, coarse-grained, brown, conglomeratic, large quartz pebbles, 1½" long, abundant, **Upper Freeport**	125	175	
Concealed	19.5	194.5	
Coal, Lower Freeport	0.5	195	145'
Sandstone, massive, **Lower Freeport**	25	220	
Concealed, mostly sandy shale	40	260	65'
Shale, sandy, dark	5	265	
Sandstone, grayish-white, brown, current-bedded, **Upper East Lynn**, to top of J. M. Gross No. 1 Well (121 on Map II) (840' L.)	60	325	

	Thickness. Feet.	Total. Feet.	
Continued with Log of Gross Well:			
Conductor	18	343	
Unrecorded (10" casing, 24')	17	360	
Lime	90	450	
Sand	3	453	
Coal, "No. 5 Block"?	2	455	195'
Pottsville Series (1200')			
Lime	45	500	
Sandstone, Homewood and Upper Coalburg	150	650	
Slate	35	685	
Lime	40	725	
Slate	73	798	
Coal, Cedar Grove?	4	802	347'
Lime (8¼" casing, 490')	13	815	
Slate	20	835	
Sand	170	1005	
Slate	70	1075	
Sand	110	1185	
Slate	10	1195	
Sand	152	1347	
Slate	18	1365	
Salt Sand	110	1475	
Slate	15	1490	
Sand (bottom of Salt Sand)	165	1655	853'
Mauch Chunk Series (200')			
Red rock	3	1658	
Lime (6⅝" casing, 1355')	57	1715	
Slate	30	1745	
Lime	105	1850	
Pencil slate	5	1855	200'
Greenbrier Limestone (110')			
Big Lime	110	1965	110'
Pocono Sandstones (400')			
Sand, Big Injun (gas at 1650')	40	2005	
Slate	10	2015	
Lime	85	2100	
Slate	115	2215	
Lime, shells, and slate	150	2365	400'
Catskill Sandstones (382')			
Lime, slate, and shells	300	2665	
Sand, Gordon?	10	2675	
Slate to bottom of hole	72	2747	382'

In the extreme northeastern edge of Henry District, the writer measured the following section with aneroid southeastward along the hill road to the bed of Elk River at the mouth of Two Run, which agrees closely with that given on a preceding page of this Chapter for Ivydale in Otter District:

Section 0.5 Mile Southwest of Ivydale, Henry District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (180')			
Shale, red, sandy, to thin sandstone	35	35	
Shale, green	20	55	
Concealed	15	70	
Shale, red	10	80	
Limestone, impure	0.5	80.5	
Shale, sandy, green and red	29.5	110	
Sandstone, micaceous, green, and fine-grained, **Upper Mahoning**	25	135	
Concealed	15	150	
Spring	...	150	
Sandstone, massive, brown, **Lower Mahoning**	30	180	
Spring	...	180	180'
Allegheny Series (320')			
Concealed and shale, brown, with iron ore	10	190	
Sandstone, massive, coarse-grained, brown, friable, **Upper Freeport**	15	205	
Concealed	15	220	
Shale, sandy	10	230	
Concealed to bench	10	240	
Shale, red, brown, sandy	40	280	
Sandstone	10	290	
Concealed	5	295	
Shale, sandy, brown, and green	15	310	
Sandstone	5	315	
Shale, brown, sandy	15	330	
Sandstone	15	345	
Concealed and shale	14.8	359.8	
Coal, slaty, Upper Kittanning, (1000' B.)	0.2	360	180'
Shale, sandy	4	364	
Sandstone, very conglomeratic basal 15', **Upper East Lynn**	46	410	
Concealed and sandstone	35	445	85'
Fire clay shale, **Middle Kittanning Coal horizon**	5	450	
Sandstone, platy	20	470	
Concealed to spring on bench, **"No. 5 Block"**	30	500	55'
Pottsville Series—Kanawha Group (150')			
Sandstone, platy, grayish-white, hard, very conglomeratic in lower half, **Homewood**	85	585	
Concealed to Elk River	60	645	
Coal, Stockton, in bed of Elk, reported	5	650	150'

Three-fourths mile southeastward in the same District, Gawthrop measured with aneroid the following section, northward down the valley wall of Elk River to the bed of the latter:

Section 1 Mile Due South of Ivydale, Henry District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (25')			
Shale	10	10	
Concealed	10	20	
Coal, prospect, closed, "**No. 5 Block**" (No. 682 on Map II)	...	20	20'
Shale, dark	3	23	
Coal, (3")	...	23	
Shale	2	25	
Pottsville Series—Kanawha Group (147')			
Sandstone, massive, gray, hard, pebbly, **Homewood**	70	95	
Shale, with **coal spars**, (2"), **Stockton "A"**	2	97	
Sandstone, massive, coarse-grained, pebbly	38	135	
Slate, dark, with plant fossils	2	137	
Coal 0' 2" Slate 0 1 **Coal**, splint 1 7 Slate, black 0 2 **Coal**, splint 1 0 **Stockton, Upper Bench** (765' B.) (No. 774 on Map II)	3	140	120'
Concealed by water	4	144	
Sandstone, massive	6	150	
Coal, gas 0' 10" **Coal**, splint 1 4 **Stockton, Lower Bench** (753' B.) (2' 2").	2	152	
Shale and concealed to Elk River	20	172	32'

The following section was measured with aneroid by Gawthrop on the west hillside of Whetstone Run, just above the mouth of the latter:

Whetstone Section, Henry District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (307')			
Concealed and sandstone, massive, coarse-grained, pebbly, **Upper Freeport**	15	15	
Concealed on bench, **Lower Freeport Coal horizon**, (1010' B.)	10	25	
Concealed	100	125	
Concealed on bench, **coal blossom, Upper Kittanning Coal horizon**	5	130	130'
Concealed	15	145	
Sandstone, massive, gray, making cliff, **Upper East Lynn**	25	170	
Concealed	105	275	
Sandstone, massive, brown, hard	17.8	292.8	
Coal, splint, Stockton "A"? (735' B.) (2' 2")	2.2	295	165'
Shale and concealed to bed of Whetstone Run	12	307	12

One-fourth mile southwest of the mouth of Spread Run, Gawthrop measured the following section with aneroid northeastward down the steep west hillside of Elk River:

Section ¼ Mile Southwest of Spread, Henry District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (217.7')			
Concealed, with sandstone	35	35	
Concealed, with shale, to bench, **Upper Kittanning Coal horizon** (930' B.)	10	45	45'
Concealed	10	55	
Sandstone, massive, gray, making cliff, **Upper East Lynn**	60	115	70'
Sandstone, partly concealed	40	155	
Concealed, with sandstone	30	185	70'
Sandstone, massive, brown	30	215	
Coal, semi-splint 1' 4" Slate 0 4 **Coal**, soft, gas 1 0 **Stockton "A"?** (755' B.)	2.7	217.7	32.7'
Pottsville Series (50')			
Shale and concealed to bed of Elk River	50	267.7	50'

In the central portion of Henry District (Clay), the following succession is obtained by combining a section measured with aneroid by the writer northwestward from the summit of Mt. Pisgah, with the log of the Jacob Tome Institute No. 1 Well (124 on Map II, located on the south bank of Elk River, 0.2 mile north of the mouth of Pisgah Run). The well in question was completed January 3, 1909, by the Mt. Pisgah Oil and Gas Company, and its log was kindly furnished the Survey by H. B. Davenport, Secretary and Treasurer. That portion included in the Conemaugh Series was measured along the private road immediately northwest of the knob; and that, from the top of the Upper Freeport Sandstone down to the base of the Coalburg Coal, was determined along the steep ravine on the south hillside of Elk River, 0.4 mile southwest of the mouth of Buffalo Creek. The section is very important, in that the coal, formerly mined on a commercial scale at Dundon, is shown to be the Coalburg bed, since it belongs 40 to 50 feet below the undoubted Stockton seam with its overlying marine fossiliferous shale—representing the Kanawha Black Flint. The coal at 470 feet from the top is the **Upper Kittanning** seam, instead of the No. 5 Block, as correlated in former State Reports:

Clay Section, Henry District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (285′)			
Concealed from summit of Pisgah Knob....	20	20	
Sandstone, green, **Saltsburg**..............	45	65	
Concealed, steep slope....................	10	75	
Concealed in bench, **Bakerstown Coal horizon**	5	80	80′
Concealed, mostly sandstone and sandy shale	55	135	
Sandstone, **Buffalo**........................	30	165	
Concealed	20	185	
Shale, red................................	10	195	
Sandstone, coarse, brown, friable, **Upper Mahoning**, partly concealed..............	90	285	205′
Allegheny Series (330′)			
Sandstone, massive, very conglomeratic, making cliff, **Upper Freeport**...............	100	385	
Bench, concealed..........................	5	390	
Sandstone, **Lower Freeport**................	70	460	
Shale, sandy, iron ore nodules..............	10	470	
Coal, Upper Kittanning, (at Opening No. 458 on Map II), (1075′ B.)................	3.3	473.3	188.3′
Sandstone, massive, coarse, grayish-white, brown, very pebbly in upper portion, **Upper East Lynn**......................	96.7	570	
Shale, dark, ferriferous, current-bedded, pitching at angle of 70° to the horizontal	3	573	
Shale, **with coal spars at base, Middle Kittanning Coal horizon**..................	5	578	104.7′
Sandstone, grayish-white, current-bedded, **East Lynn**............................	36	614	
Coal, slaty (8″), "No 5 Block"?, Lower Kittanning?	1	615	37′
Pottsville Series (1515′)			
Sandstone, grayish-white, current-bedded, **Homewood**	85	700	
Shale, sandy..............................	1	701	
Concealed	11	712	
Shale, flaggy and sandy...................	6	718	
Coal, bony cannel......2′ 0″ Shale, siliceous.........2 0 Slate, dark.............0 6 **Coal, splinty**..........0 6 } **Stockton "A"**	5	723	108′
Shale and concealed.......................	3	726	
Sandstone, massive........................	7	733	
Shale	1	734	
Coal (1″)................................	0.1	734.1	
Shale, concealed, and shale...............	2.9	737	
Sandstone, flaggy, shaly at base............	23	760	
Concealed and shale, dark, siliceous, **marine fossils, Kanawha Black Flint horizon**, not well exposed here.................	20	780	
Coal, slaty, Stockton.....................	5	785	62′
Sandstone, **Upper Coalburg**, massive, greenish-gray, coarse.......................	40	825	

	Thickness. Feet.	Total. Feet.	
Coal, splinty 2′ 0″ Shale, gray 0 1 **Coal, softer** 2 11 **Coalburg, “Dundon”**	5	830	45′
Sandstone, **Lower Coalburg,** to top of Well (124 on Map II)	10	840	
Continued with Log of Well No. 124 on Map II, (704′ L.):			
Sand and gravel	40	880	
Shells	20	900	
Coal, Winifrede?	5	905	75′
Sand, **Lower Winifrede**	75	980	
Lime	20	1000	
Slate	10	1010	
Lime, sandy	35	1045	
Slate	35	1080	
Lime	30	1110	
Slate	35	1145	
Sand	30	1175	
Coal, No. 2 Gas?	5	1180	275′
Slate	55	1235	
Sand	25	1260	
Slate	10	1270	
Lime shells	55	1325	
Slate, black	20	1345	
Lime shells	20	1365	
Slate, black	25	1390	
Slate, brown	30	1420	240′
Sand, **“Gas” of Rosedale, Nuttall?** (gas at 590′; water at 615′)	85	1505	
Slate	20	1525	
Sand (water, 735-760′)	90	1615	
Shale	40	1655	
Sand, hard 40′ Sand, soft 40 **Salt of Rosedale, Harvey?**	80	1735	
Sand, water	10	1745	
Sand, pebbly	5	1750	
Lime, sandy	35	1785	
Slate	95	1880	
Coal, Beckley?	5	1885	465′
Lime	15	1900	
Sand, broken	15	1915	
Slate	5	1920	
Sand, broken	30	1950	
Slate, black	25	1975	
Lime, black	20	1995	
Slate, black	40	2035	
Lime	10	2045	
Sand, broken	5	2050	
Shells and slate	25	2075	
Lime, sandy	25	2100	
Sand	30	2130	245′
Mauch Chunk Series (240′)			
Red rock	40	2170	
Broken up	45	2215	
Red rock	30	2245	

	Thickness. Feet.	Total. Feet.	
Lime, gray	5	2250	
Sand, Maxton	5	2255	
Lime, black	3	2258	
Red rock	7	2265	
Slate, black, cave	15	2280	
Lime, black	80	2360	
Slate	10	2370	240'
Greenbrier Limestone (170')			
Lime, broken	15	2385	
Lime, gray, hard	15	2400	
Lime, brown	15	2415	
Lime, white, sandy	5	2420	
Lime, brown (gas at 1605')	30	2450	
Lime, broken	10	2460	
Lime, white	20	2480	
Lime, sandy	5	2485	
Lime, white	15	2500	
Lime, sandy	5	2505	
Lime, white	10	2515	
Lime, white, flaky, (show of oil at 1695', in lime)	25	2540	170'
Pocono Sandstones (425')			
Big Injun Sand (show of oil and gas at 1707'; bottom, 1716')	16	2556	
Slate, black	25	2581	
Lime shells and slate	64	2645	
Shale	45	2690	
Lime shells	10	2700	
Slate	45	2745	
Lime shells	15	2760	
Shale, gray	50	2810	
Lime shells	5	2815	
Slate	15	2830	
Lime shells	5	2835	
Slate, black	65	2900	
Lime shells, break	5	2905	
Shale	40	2945	
Lime shells	20	2965	425'
Catskill Sandstones (370')			
Shale, blue	25	2990	
Slate, white	55	3045	
Lime shells, sandy	15	3060	
Slate	15	3075	
Black lime, hard	10	3085	
Shale, gray	30	3115	
Shale, blue	25	3140	
Slate	25	3165	
Shale	40	3205	
Slate	15	3220	
Shale, blue	40	3260	295'
Sand, broken, Gordon	5	3265	
Shale, blue	20	3285	
Lime shells	30	3315	
Slate, black, and lime, to bottom	20	3335	75'

"Oil in Big Injun Sand, amber-colored; oil in bottom of Big Lime, green; 10" casing, 45'; 8¼" casing, 473'; 6⅝" casing, 1450'; 5 3/16" liner, 116', set at 1540'."

In the foregoing section, the results are greater than they should be in that portion included in the Allegheny Series, owing to the rapid northwest dip of the strata at the point the determinations were made.

The following section was measured with aneroid by the writer southwestward along the hill road on Fitzwater Run to the bed of Elk River at Dundon:

Dundon Section, Henry District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (85')			
Sandstone, massive, coarse-grained, brown, no pebbles seen, **Lower Mahoning**	85	85	85'
Allegheny Series (360')			
Coal blossom, (6"), Upper Freeport (Coal Exposure No. 337 on Map II), (1180' B.)	0.5	85.5	
Sandstone, coarse-grained, brown, pebbly, **Upper Freeport**	69.5	155	
Bench, **Lower Freeport Coal horizon**	10	165	
Concealed	50	215	
Spring, concealed and sandstone	40	255	
Concealed, steep slope	180	435	
Spring, bench, **No. 5 Block Coal? horizon**	10	445	360'
Pottsville Series—Kanawha Group (135')			
Concealed	60	505	
Coal blossom, Stockton	...	505	60
Sandstone	25	530	
Coal, Coalburg, with partings	5	535	30'
Sandstone to railroad grade at Dundon, **Lower Coalburg**	15	550	
Concealed to Elk River (680' B.)	30	580	45'

Three miles eastward in the same District, Gawthrop measured with aneroid the following section from the summit of a high knob southward along the second-class road. The intervals are slightly less than they should be, owing to the prevailing northwest dip of the strata here. The coal at 620 feet from the top is undoubtedly the Coalburg bed, since it was traced directly up Buffalo Creek from Dundon where its correlation is fixed:

Section 0.7 Mile Southwest of Sand Fork Station, Henry District.

	Thickness. Feet.	Total. Feet.	
Conemaugh and Allegheny Series (465')			
Concealed from top of knob to **bench**	40	40	
Concealed	170	210	
Bench, **Lower Freeport Coal horizon** (1245' B.)	...	210	
Concealed	70	280	
Bench, **Upper Kittanning Coal horizon**	...	280	280'
Concealed	80	360	
Bench, **Middle Kittanning Coal horizon**	...	360	
Sandstone, massive, gray, pebbly, **East Lynn**	20	380	
Concealed	85	465	185'
Pottsville Series (205')			
Sandstone, massive, broken, partly concealed	60	525	
Concealed	10	535	
Shale, brownish-gray	10	545	
Sandstone, massive	20	565	
Concealed	55	620	
Coal, Coalburg (835' B.)	2	622	157'
Sandstone, to railroad, **Lower Coalburg**	48	670	48'

Two miles due south of Cressmont in the same District, the writer measured with aneroid the following section northward from the summit of a high knob, mostly along a trail, to the bed of Hickory Fork, 0.4 mile northwest of the mouth of Lick Run. The results are greater than they should be, owing to a dip of about 30 feet in the strata to the northwest between the two extremes:

Section 2 Miles Northeast of Wallowhole Knob, Henry District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (305')			
Concealed in steep slope from summit of knob, mostly sandstone, coarse-grained, brown, conglomeratic, large quartz pebbles, **Upper Freeport**	80	80	
Concealed	14	94	
Coal digging, closed, Lower Freeport (No. 360 on Map II)	1	95	95'
Bench, with iron ore fragments	5	100	
Concealed, steep slope, mostly sandstone, apparently not pebbly, but green, medium- to fine-grained, **Lower Freeport**	70	170	
Bench, **Upper Kittanning Coal horizon** (1390' B.)	10	180	85'
Concealed, steep slope, with grayish-white, conglomeratic sandstone, **East Lynn**	115	295	

	Thickness. Feet.	Total. Feet.	
Bench, **No. 5 Block Coal** horizon	10	305	125′
Pottsville Series—Kanawha Group (320′)			
Concealed, steep slope	180	485	
Bench, **Coalburg Coal** horizon (1070′ B.)	10	495	190′
Concealed, steep slope, and sandstone, **Winifrede**	55	550	
Bench	10	560	
Sandstone, current-bedded, to bed of Hickory Fork at trail fork, **Lower Winifrede**	65	625	130′

Two miles southwestward in Henry District, the following section was measured with aneroid by the writer from the summit of Wallowhole Knob southeastward along trail to the bed of Jim Young Fork of Lilly, the results being considerably less than they should be, due to the dip of the strata to the northwest between the two extremes. The correlation of the Upper Freeport Sandstone and the horizon indicated for the Coalburg Coal are fixed with a fair degree of accuracy:

Wallowhole Knob Section, Henry District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (70′)			
Sandstone, pebbly, concealed, and shale, from summit of knob	70	70	70′
Allegheny Series (325′)			
Sandstone, coarse, brown, pebbles, large but not quite so abundant, mostly concealed, **Upper Freeport**	95	165	
Bench	10	175	
Concealed, mostly sandstone, large quartz pebbles in debris, **Lower Freeport**	60	235	
Bench, **Upper Kittanning Coal** horizon	5	240	170′
Sandstone, grayish-white, hard, very conglomeratic, large white quartz pebbles, **Upper East Lynn**	105	345	
Concealed, steep slope	40	385	
Bench, flat, **"No. 5 Block" Coal** horizon	10	395	155′
Pottsville Series (305′)			
Concealed, steep slope	50	445	
Bench, flat, **Stockton Coal** horizon	10	455	
Concealed, steep slope	65	520	
Bench, flat, **Coalburg Coal** horizon (1175′ B.)	10	530	135′
Concealed, mostly sandstone, in steep slope	85	615	
Concealed, steep bench	10	625	
Sandstone, greenish-gray, medium-grained	60	685	
Concealed to bed of Jim Young Fork, (1005′ B.)	15	700	170′

About 4 miles southeast of Clay, the following succession is obtained by combining a section measured with aneroid by Gawthrop northeastward on a point on the west hillside of Sinnett Branch of Lilly, with the log of the J. D. Cameron Well—No. 125 on Map II, located on Sinnett Branch, 1.6 miles southeast of the mouth of the latter. The well in question was completed in 1911 by the Hope Natural Gas Company and its log was kindly furnished the Survey by the United Fuel Gas Company. No oil or gas was encountered in the boring. The coal at 396 feet from the top of the section is undoubtedly the Stockton, according to Gawthrop, who reports the Kanawha Black Flint on the east bank of Sinnett Branch, 1 mile northwest of the well:

Sinnett Branch of Lilly Fork Section, Henry District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (310')			
Concealed from top of point	75	75	
Concealed to bench, **Upper Kittanning Coal horizon**	35	110	110'
Sandstone, coarse-grained, pebbly, partly concealed, **East Lynn**	35	145	
Concealed, steep slope	165	310	
Bench, **"No. 5 Block" Coal horizon**	...	310	200'
Pottsville Series (1521')			
Concealed to top of **J. D. Cameron Well (No. 125 on Map II)**	50	360	
Continued with Log of Cameron Well:			
Conductor	13	373	
Unrecorded	23	396	
Coal, Stockton	1	397	87'
Lime and sand	31	428	
Coal, Coalburg	5	433	36'
Sand and lime	97	530	
Sand	65	595	
Coal, Chilton	4	599	166'
Slate	244	843	
Coal, Powellton?	4	847	248'
Slate	23	870	
Sand	45	915	
Coal, Eagle?	5	920	73'
Slate	25	945	
Lime	35	980	
Slate	49	1029	
Lime	16	1045	
Sand	135	1180	
Slate	40	1220	
Lime	30	1250	
Slate	15	1265	

	Thickness. Feet.	Total. Feet.	
Lime	15	1280	
Sand	118	1398	
Slate	165	1563	
Sand	49	1612	
Slate	110	1722	
Lime	8	1730	
Slate	10	1740	
Sand	91	1831	911′
Mauch Chunk Series (247′)			
Red rock	54	1885	
Lime	5	1890	
Sand	74	1964	
Slate	26	1990	
Pencil Cave	12	2002	
Lime	46	2048	
Pencil Cave	30	2078	247′
Greenbrier Limestone (150′)			
Big Lime	150	2228	150′
Pocono Sandstones and Devonian (1429′)			
Sand, **Big Injun**	61	2289	
Red sand	50	2339	
Slate, white	251	2590	
Slate and shells	234	2824	
Unrecorded	141	2965	
Sand	9	2974	
Slate and shells	31	3005	
Lime	17	3022	
Slate	12	3034	
Lime	24	3058	
Slate	12	3070	
Lime	36	3106	
Slate and shells	48	3154	
Lime	24	3178	
Slate	21	3199	
Lime	26	3225	
Slate and lime	31	3256	
Lime	44	3300	
Slate and shells	47	3347	
Lime	25	3372	
Slate	20	3392	
Lime	32	3424	
Slate	12	3436	
Lime	34	3470	
Slate	19	3489	
Lime	18	3507	
Slate and shells	38	3545	
Slate and lime	112	3657	1429′

"Four bailers of water at 990 feet below top of well. Hole full of water at 1030 feet below top of well. Gas show at 2230 feet below top of well. Steel-line measurement from 1530 to 2700 feet. Sand-line measurement, 2700 feet to bottom. Steel-line measurement to bottom, 3297 feet. 13″ casing, 102′; 10″ casing, 510′; 8¼″ casing, 1135′; 6⅝″ casing, 1752′."

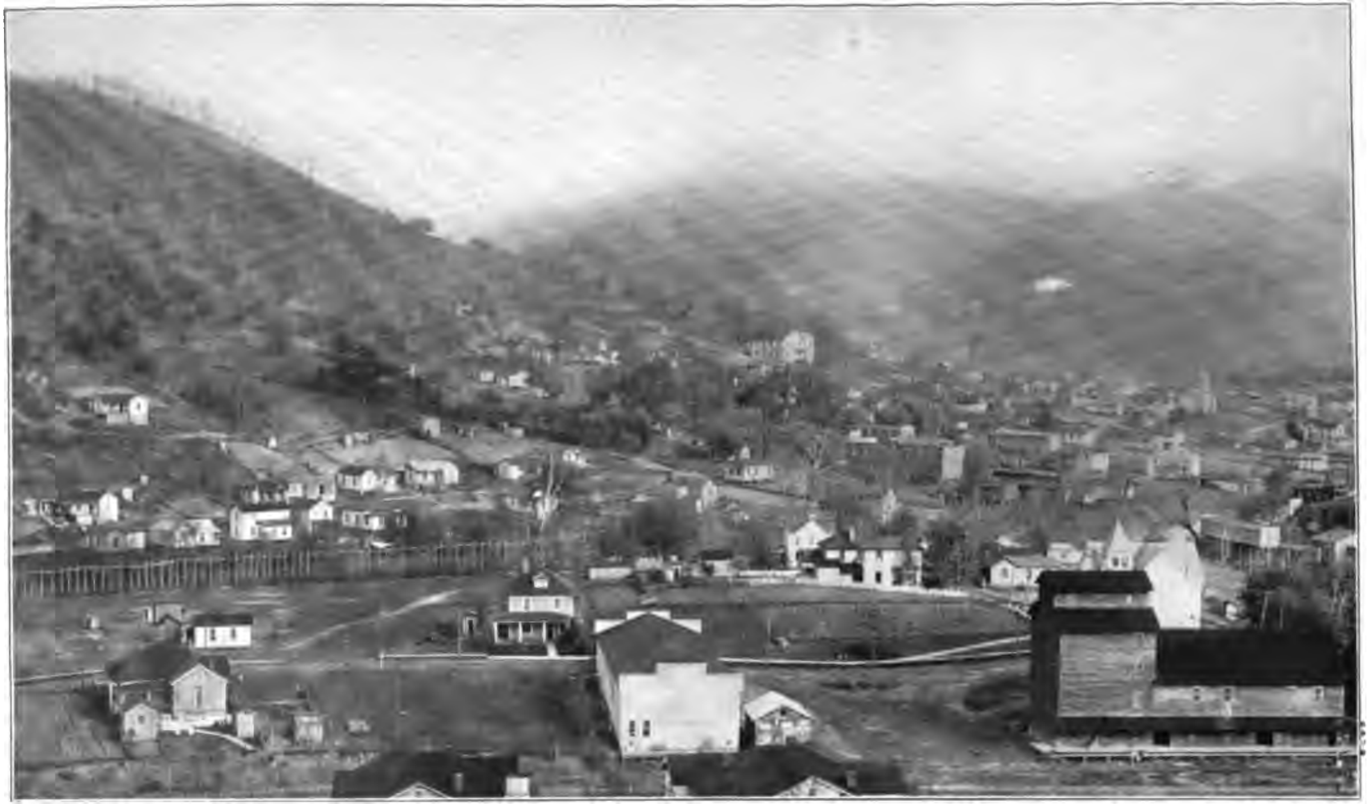

PLATE VI.—Showing town of Burnsville, Braxton County, looking southeast, and topography of Monongahela and Conemaugh Series.

Slightly over a mile southward in the same District, Gawthrop measured the following section with aneroid down the north hillside of Lilly Fork, 0.6 mile east of the mouth of Big Branch, the results being less than they should be, owing to a northwest dip of the strata of 25 to 30 feet between the two extremes:

Section 1.7 Miles East of Cove Hollow School, Henry District.

		Thickness. Feet.	Total. Feet.	
Allegheny Series (165′)				
Sandstone, massive, coarse-grained, brown, hard, pebbly, making cliff................25′ Concealed, sandstone, massive, broken to flaggy, medium-grained, micaceous.........35 Sandstone, massive, coarse-grained, brown, medium-grained, pebbly at top, making cliff..25	**Upper East Lynn**...	85	85	
Sandstone, massive, medium-grained, brown, flaggy, making cliff, **East Lynn**.........		80	165	165′
Pottsville Series—Kanawha Group (295′)				
Sandstone, massive to broken, coarse-grained, mostly concealed, **Homewood**..........		50	215	
Bench, slight..............................		...	215	
Concealed and sandstone...................		90	305	
Concealed on bench, **Coalburg Coal horizon** (1065′ B.)............................		10	315	150′
Sandstone, massive, with sandstone, medium-grained, hard, **Lower Coalburg**.........		35	350	
Concealed, with sandstone, to bed of Lilly Fork		110	460	145′

Slightly less than 2 miles southeastward in Henry District, the writer measured the following section with aneroid northward down a point via an opening in the Coalburg Coal to the bed of Laurel Fork of Lilly, 0.3 mile southeast of the mouth of the former, the results being somewhat less than they should be, owing to the prevailing northwest dip of the rocks:

Laurel Fork of Lilly Fork Section, Henry District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (155')			
Sandstone, grayish-white, conglomeratic, making cliff, very hard, **Upper East Lynn**	30	30	
Bench, **Middle Kittanning Coal horizon**	10	40	
Sandstone, grayish-white, platy, current-bedded, making cliff, **East Lynn**	35	75	
Concealed, steep slope, mostly sandstone	75	150	
Coal blossom, heavy, in old tree grove, "**No. 5 Block**," (1355' B.)	5	155	155'
Pottsville Series (405')			
Sandstone, grayish-white, flaggy, **Homewood**	20	175	
Concealed, steep slope	10	185	
Bench	5	190	
Concealed, steep slope	30	220	65'
Coal blossom, in tree grove, **Stockton "A"**	...	220	
Concealed, steep slope	106	326	
Coal, at digging, closed, **Coalburg** (reported 4' thick) (No. 843 on Map II) (1180' B.)	4	330	110'
Slate, concealed, and unrecorded to bed of Laurel Fork	230	560	230'

In the extreme southeastern edge of Henry District (Clay), the following succession is obtained by combining a section, measured with aneroid by the writer, with the detailed log of a diamond drill boring—No. 45 on Map II. The upper 272 feet of the section was measured from the summit of a knob, 0.8 mile southwest of the mouth of Beech Fork, northeastward to a closed prospect opening in the No. 5 Block Coal bed; and that extending on down to the top of the boring was determined from another prospect opening in the same coal northeastward to the bed of Lilly Fork, 0.2 mile southeast of the Clay-Nicholas County Line, both determinations being practically on the strike of the rocks. The boring in question is located on the north bank of Lilly Fork, 5 feet above the bed of the latter and about 150 yards west of the mouth of Beech Fork, the coal correlated with the Hernshaw cropping in the bed of the former stream opposite the well:

Section at Mouth of Beech Fork of Lilly Fork, Henry District.

	Thickness.		Total.		
	Ft.	In.	Ft.	In.	
Allegheny Series (285')					
Concealed, steep slope, from top of knob	55	0	55	0	
Bench, Lower Freeport Coal horizon	10	0	65	0	65'
Concealed, steep slope.............	50	0	115	0	
Bench, Upper Kittanning Coal horizon	10	0	125	0	60'
Sandstone, grayish-white, coarse-grained, very conglomeratic, pebbly, resting unconformably on ledge below, Upper East Lynn	55	0	180	0	
Sandstone, East Lynn, current-bedded, medium-grained, hard, and concealed, steep slope and slate	92	0	272	0	
Coal ....2' 0" Slate, black 2 0 Coal ....9 0 "No. 5 Block," (prospect closed, section as given by native, A. A. Hamrick).	13	0	285	0	160'
Pottsville Series—Kanawha Group (838' 8¾")					
Concealed in steep slope..........	120	0	405	0	
Kanawha Black Flint, typical of Kanawha Valley..............	5	0	410	0	125'
Bench, Stockton Coal horizon......	10	0	420	0	
Concealed, steep slope............	55	0	475	0	
Bench, Coalburg Coal horizon.....	10	0	485	0	75'
Concealed, steep slope............	85	0	570	0	
Coal, splinty, visible.0' 6" Shale, gray.........3 0 Sandstone ....1 0 Coal, gas, 5" to.....0 6 Chilton "A".....	5	0	575	0	
Shale, bluish-gray, argillaceous, marine fossils abundant, several species, Producti abundant, Winifrede Limestone horizon..	10	0	585	0	
Coal, medium-soft.0' 0½" Slate ....0 0⅛ Coal, medium-soft.0 5 Bone, 1" to.......0 2 Coal, medium-soft.0 5 Bone, hard........0 2 Coal, hard, with sulphur balls..2 7 Chilton	3	10	588	10	103' 10"
Slate	1	2	590	0	
Sandstone, massive, Lower Chilton	30	0	620	0	
Continued with Elk River Coal and Lumber Co. Boring (No. 45 on Map II), (1085' B.):					
Surface wash and gravel (14" of Hernshaw Coal, cropping 5' below top of hole)..............	13	6	633	6	

				Thickness. Ft.	In.	Total. Ft.	In.	
Black slate	3'	6 "	Williamson...	5	7½	639	1½	50' 3½"
Coal	0	4						
Slate	0	1½						
Coal	0	7						
Bone	0	5						
Coal	0	8						
Fire clay				1	3	640	4½	
Gray sandy shale	7'	10 "	Upper Cedar Grove Sandstone	46	9½	687	2	
Fine-grained gray sandstone or shale	19	4						
Light sandy shale	19	7½						
Slate				4	4	691	6	
Coal	0'	6"	Cedar Grove..	1	10	693	4	54' 2½"
Bone	0	2						
Coal	0	10						
Bone	0	2						
Coal	0	2						
Fire clay (bastard)				0	6	693	10	
Sandy shale	4'	6"	...	8	7	702	5	
Light sandy shale	2	3						
Sandy shale	1	10						
Dark slate or shale				4	7	707	0	
Light sandy shale				1	11½	708	11½	
Light fine gray sandstone, shaly...				19	0	727	11½	
Sandy shale or slate				4	9½	732	9	
Light fine-grained gray sandstone	7'	1½"	Peerless	23	3	756	0	
Dark fine-grained gray sandstone	1	5½						
Light fine-grained gray sandstone	14	8						
Black slate soapstone	2'	8"	...	17	3	773	3	
Black slate	14	7						
Coal and slate	0'	5 "	**Campbell Creek..... (No. 2 Gas)**	2	2	775	5	82' 1"
Coal	0	7						
Bony coal	0	1½						
Coal	1	0½						
Fire clay (bastard)				0	6½	775	11½	
Light fine-grained gray sandstone	31'	5"	Brownstown Sandstone	65	9	841	8½	
Light fine-grained gray sandstone, streaked	14	6						
Light fine-grained gray sandstone	7	1						
Shale sandstone, gray streaked	12	9						
Coal	0'	11½"	Powellton..	1	3	842	11½	67' 6½"
Slate and bone	0	3½						
Fire clay				1	1	844	0½	
Fire clay and slate, mixed				3	10	847	10½	
Light shale	6'	1"	...	21	11	869	9½	
Light-gray sandy shale	15	10						
Light-gray sandstone, Eagle				49	11½	919	9	

				Thickness.		Total.		
				Ft.	In.	Ft.	In.	
Black sandy shale				13	9	933	6	
Black slate				14	6	948	0	
Coal, bony	0'	7 "	**Eagle..**	2	9½	950	9½	107' 10"
Coal	2	2½						
Fire clay				3	0	953	9½	
Dark sandy shale				21	9	975	6½	
Light sandy shale				8	4	983	10½	
Coal, bony	0'	1 "						
Coal	0	6	**Little**					
Slate	0	1	**Eagle..**	2	3½	986	2	35' 4½"
Coal	1	7½						
Light sandy shale				26	7	1012	9	
Black slate (sandy), **Eagle Black Slate and Limestone?**				35	8	1048	5	62' 3"
Fire clay, **Little Cedar Coal horizon**				1	6	1049	11	
Light-gray shale				25	8	1075	7	
Gray sandstone	7'	7"	**Upper**					
Gray sandstone, streaked	26	10	**Gilbert?**	34	5	1110	0	
Gray sandstone	4'	3 "						
Shale	0	7						
Sandstone	0	9½						
Gray sandy shale	1	4						
Gray sandstone	1	5	**Lower**					
Sandy shale	0	2¼	**Gilbert?**	13	8¾	1123	8¾	75' 3¾"
Gray sandstone	2	1½						
Sandy shale	0	8						
Rough sandstone streaked with coal, **Gilbert**	2	4½						
Pottsville Series—New River Group (254' 4¼")								
Gray sandstone				6	9	1130	5¾	
Gray sandy shale (very slaty)				48	10	1179	3¾	
Gray sandstone with coal streaks				8	10	1188	1¾	
Slate				3	10	1191	11¾	
Fire clay				3	2	1195	1¾	
Sandy shale				9	2	1204	3¾	
Gray shale				10	11	1215	2¾	
Gray sandstone				16	8	1231	10¾	
Sandy shale				1	6	1233	4¾	
Gray sandstone				4	4	1237	8¾	
Dark shale				0	3½	1238	0¼	
Gray sandstone				4	2½	1242	2¾	
Gray sandstone with foreign substances imbedded				0	8	1242	10¾	
Gray sandstone streaked (very slaty)				19	11¼	1262	10	
Dark sandy shale				8	9	1271	7	
Black slate				3	3	1274	10	
Fire clay				3	1	1277	11	
Dark sandy shale				14	1	1292	0	
Gray sandy shale (slaty)				45	5	1337	5	
Dark sandy shale (white streaks)				2	4	1339	9	
Soft white sand mixed with shale				0	6	1340	3	
Sandy shale				7	4	1347	7	

	Thickness.		Total.		
	Ft.	In.	Ft.	In.	
Fire clay	0	10	1348	5	
Sandy shale	2	4	1350	9	
Soft white sandstone (crumbles)	0	4	1351	1	
Compact fine-grained hard sandstone	1	1	1352	2	
Dark shale or slate	0	3	1352	5	
Compact fine-grained hard sandstone	0	7½	1353	0½	
Dark shale or slate	0	4	1353	4½	
Hard siliceous sandstone (white)	1	5	1354	9½	
Dark shale or slate	0	0½	1354	10	
Very hard siliceous sandstone (white)	0	7½	1355	5½	
Very hard siliceous sandstone (light)	1	10	1357	3½	
Hard grayish-white sandstone	5	4	1362	7½	
Slate, black	0	0¼	1362	7¾	
Hard grayish-white sandstone	0	6½	1363	2¼	
Black slate	0	0¾	1363	3	
Hard grayish-white sandstone	0	3½	1363	6½	
Black slate	0	1½	1363	8	
Very hard grayish-white sandstone to bottom of hole	14	5	1378	1	254′ 4¼″

In the southwestern edge of the same District, the writer measured with aneroid the following section from the summit of the knob, 0.5 mile northeast of the mouth of Leatherwood Creek, southeastward to the bed of Cove Hollow, 0.2 mile above the mouth of the latter. The results are less than they should be, owing to a dip of 50 to 60 feet to the northwest between the two extremes. The coal at 619.8 feet from the top is the same as mined commercially at Pisgah by the Elliott Splint Coal Company, and that was once operated at Dundon. The coarse and pebbly Upper East Lynn Sandstone rests unconformably on the East Lynn ledge proper, thus cutting away the Middle Kittanning Coal:

Morocco Section, Henry District.

	Thickness.	Total.	
Conemaugh Series (110′)	Feet.	Feet.	
Concealed, steep slope, from summit of knob	40	40	
Bench	5	45	
Concealed, steep slope	30	75	
Bench	5	80	
Concealed, steep slope	30	110	110′
Allegheny Series (385′)			
Bench, Upper Freeport Coal horizon	5	115	

				Thickness. Feet.	Total. Feet.	
Sandstone, coarse-grained, brown, large quartz pebbles, **Upper Freeport**				80	195	
Bench, **Lower Freeport Coal horizon**				10	205	
Sandstone, massive, coarse, brown, pebbly				65	270	
Bench				15	285	
Bench, **Upper Kittanning Coal horizon**				10	295	185'
Sandstone, current-bedded, grayish-white, massive, pebbly at top, **Upper East Lynn** and **East Lynn**				155	450	
Concealed, steep slope				23	473	
Concealed, bench				4.7	477.7	
Coal blossom, No. 5 Block "Rider"				0.3	478	
Shale, with sandstone				12.7	490.7	
Cannel	0'	2"	**"No. 5 Block," Lower Kittanning** (No. 683 on Map II)	4.3	495	200'
Shale, gray, argillaceous	1	4				
Coal, slaty	0	8				
Shale, gray, argillaceous	1	10				
Coal, slaty	0	3				
Pottsville Series (185')						
Concealed				32	527	
Shale, sandy				6	533	
Coal	0'	3"	**Stockton "A"**.	1.8	534.8	39.8'
Shale, gray	0	3				
Coal, splinty	1	4				
Concealed, steep slope, mostly sandstone				80.2	615	
Sandstone, massive				4.8	619.8	
Coal, gray splint, hard	1'	7"	**Coalburg** (810' B.)	5.2	625	90.2'
Shale, gray and hard	0	4				
Coal, gas, medium-hard	1	7				
Coal, cannel, slightly bony	1	1				
Bone	0	3				
Coal, gas, 3" to	0	4				
Concealed, mostly sandstone, and sandstone				45	670	
Concealed to bed of Cove Hollow				10	680	55'

Slightly over three miles southeastward in the same District, the writer measured with aneroid the following section down the north hillside of Leatherwood Creek, just east of the road fork and 1¼ miles east of the mouth of Right Fork. The section is very important, in that the relative positions of the Upper Kittanning, No. 5 Block, and Stockton Coals are correctly indicated, since the Kanawha Black Flint is exposed in the run immediately northwest, directly over the Stockton and 40 to 45 feet above the Coalburg seam at an opening in the latter on the east bank of the run in question:

Section 2 Miles S. 10° W. of Cove Hollow Schoolhouse, Henry District.

	Thickness Feet.	Total. Feet.	
Allegheny Series (249.5')			
Concealed and fire clay shale on bench, **Upper Kittanning Coal horizon**	10	10	10'
Sandstone, grayish-white, conglomeratic, making cliff, **Upper East Lynn**	120	130	
Concealed in bench, **Middle Kittanning Coal horizon**	10	140	130'
Concealed in steep slope, mostly sandstone, **East Lynn**	68	208	
Sandstone, shaly	16	224	
Sandstone, grayish-white, and hard	5	229	
Shale, bluish-gray, sandy, plant fossils	2	231	
Coal, bony ....0' 2½"			
Shale, dark-gray 0 7			
Coal, bony, splint ...0 7			
Coal, splint 0 11			
Coal, gray splint, hard 0 10			
Coal, splint, hard ...0 10½			
"No. 5 Block" (No. 684 on Map II.)	4	235	95'
Slate, gray	12	247	
Coal, soft top, hard bottom, **Clarion, "Little No. 5 Block,"** reported (30")	2.5	249.5	
Pottsville Series (150.5')			
Concealed	28.5	278	
Coal prospect, closed, **Stockton "A,"** thickness concealed, estimated	2	280	
Concealed	10	290	
Sandstone, flaggy	10	300	
Concealed, **Stockton Coal horizon**	10	310	75'
Sandstone and concealed to bench, **Coalburg Coal horizon**	35	345	
Sandstone, **Lower Coalburg**, to bed of Leatherwood Creek	55	400	90'

Pleasant District (Clay) Sections.

Pleasant occupies the southern point of Clay County and lies immediately southwest of the District last discussed, so that its outcropping rocks belong in practically the same Series; viz, Conemaugh, Allegheny, and Pottsville, the Monongahela not being represented. In its extreme northern edge, the following section was measured with aneroid by Gawthrop on the south hillside of Elk River, 0.4 mile west of the mouth of Beechy Creek:

Section ¼ Mile Northeast of Schoonover Knob, Pleasant District.

Pottsville Series—Kanawha Group (190')	Thickness. Feet.	Total. Feet.	
Sandstone, massive, brown, with coal spars at base, **Upper Coalburg**	30	30	
Coal, gas, hard.....0' 11" Slate, black, coaly, with plant fossils ....0 7 Fire clay shale, gray ....0 6 **Coal, splint, good**..1 11 } **Coalburg** (3' 11") (850' B.) (No. 865 on Map II)	3.9	33.9	33.9'
Shale and concealed	21.1	55	
Sandstone, massive, **Upper Winifrede**	40	95	
Concealed on bench, **Winifrede Coal horizon**.	25	120	86.1'
Sandstone, massive, partly concealed, **Lower Winifrede**	52	172	
Sandstone, shaly	5	177	
Slate, black, sandy, micaceous	3	180	
Coal, splinty (7"), Chilton (705' B.)	...	180	60'
Shale and concealed, holding 1' 0" **coal** which shows in railroad cut 200' northwest at railroad grade (it is below grade here) (695' B.)	10	190	10'

At the above point the Coalburg Coal comes 300 feet below the Upper Kittanning bed.

The following section was measured with aneroid by I. C. White and the writer from the summit of a high knob down the south hillside of Elk River via the old commercial mine at Dorfee and published in Volume II(A) of the State Geological Survey Reports, page 442. In this Report only the upper 478.2 feet of the original section is used, the lower portion being obtained at another opening in the coal mined at Dorfee, 0.6 mile northeast of the entry to the old mine and on the same hillside of Elk. The presence of the Kanawha Black Flint, almost typical with its occurrence in the Kanawha Valley, shows the "Dorfee" seam to represent the **Coalburg**, instead of the Winifrede, and it is the same as that mined at Pisgah and formerly at Dundon. The interval between it and the Stockton is only 5 feet 6 inches, which is in harmony with conditions found frequently on Leatherwood Creek, the same, in the territory of this Report, ranging from 5 to 90 feet. The correlations in parentheses are revisions on the old section:

Dorfee Section, Pleasant District.

				Thickness. Feet.	Total. Feet.	
Conemaugh Series (15')						
Concealed from summit of knob				15	15	15'
Allegheny Series (340.6')						
Concealed				35	50	
Sandstone, massive, pebbly, (Upper Freeport)				20	70	
Concealed to top of bluff, with fire clay at base				20	90	
Concealed in steep bluff				50	140	
Sandstone, massive, (Lower Freeport)				25	165	
Concealed				15	180	
Shale, gray, many plant fossils				2	182	
Coal	1'	4½"	Upper Kittanning (Opening No. 463 on Map II) (3' 7")	3.6	185.6	170.6'
Shale, gray	0	2½				
Coal	2	0				
Concealed to top of very steep bluff				50	235.6	
Sandstone and concealed (horizon of No. 5 Block Coal at base)				120	355.6	170'
Pottsville Series (275.7')						
Sandstone, massive above and flaggy below, (Homewood)				20	375.6	
Concealed				102.6	478.2	
Sandstone, shaly, visible				5	483.2	
Kanawha Black Flint, shaly, with marine fossils abundant				4.5	487.7	132.1'
Coal, gas, medium-hard	1'	5"	(Stockton) (2' 5") (No. 794 on Map II)	2.4	490.1	
Shale, dark-gray	0	5				
Coal, splinty	0	7				
Shale, gray, argillaceous				5.5	495.6	
Coal, splint	0'	8"	(Coalburg) (5' 8") (No. 867 on Map II)	5.7	501.3	13.6'
Shale, dark-gray	0	6				
Coal, splint, hard	2	0				
Bone, 5" to	0	8				
Coal, splint, hard	1	10				
Slate and concealed to Coal & Coke Ry. grade				100	601.3	
Concealed to Elk River				30	631.3	130'

Five miles southeastward in the same District, the writer measured with aneroid the following section from the summit of a high knob on the divide between Middle and Leatherwood Creeks northeastward via a prospect opening in the Middle Kittanning Coal to the bed of the latter stream, ¼ mile south of the U. S. Geological Survey bench mark—798 feet above sea-level. The section is important, in that it exhibits a fine development of the Middle Kittanning Coal 110 feet below the horizon of the Upper Kittanning bed, and 90 to 95 feet above the absolute horizon of the No. 5 Block seam:

Section 2 Miles South of Morocco, Pleasant District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (375')			
Sandstone, coarse, brown, large quartz pebbles, white and blue-black, from summit of knob, **Upper Freeport**	75	75	
Bench	25	100	
Sandstone, coarse, brown, pebbly, **Lower Freeport**	55	155	
Concealed, steep slope	5	160	
Bench, **Upper Kittanning Coal horizon**	10	170	170'
Sandstone, grayish-white, pebbly, making cliff, **Upper East Lynn**	65	235	
Concealed, steep slope, and shale	37.2	272.2	
Coal and shale.....0' 7" **Coal** ....0 6 **Shale, gray**.........0 5 **Coal, semi-splint**....1 11 **Bone, 2" to**........0 3 **Coal, splint**........1 6 **Coal, gray splint**...1 0 **Coal, splint**........1 8 **Middle Kittanning** (7' 10") **(Prospect No. 538 on Map II)** (1101' L.)	7.8	280	110'
Concealed, steep slope, formed by **East Lynn Sandstone**	85	365	
Bench, **No. 5 Block Coal horizon**	10	375	95'
Pottsville Series—Kanawha Group (255')			
Concealed, steep slope	75	450	
Bench, **Stockton "A"**	10	460	
Concealed, steep slope	35	495	120'
Bench, **Stockton Coal horizon**	5	500	
Concealed	10	510	
Bench, with **coal blossom** in old tree grove, **Coalburg**	5	515	20'
Concealed, steep slope, mostly sandstone, to Leatherwood Creek	115	630	115

In the southeast edge of Pleasant District (Clay), the writer measured with aneroid the following section from the summit of the high knob on the head of Payne Branch of Sycamore Creek, northeastward along the road and trail to the bed of the latter stream via an opening in the undoubted Coalburg Coal on the east bank of Sycamore, just below the trail fork:

Section at Head of Sycamore Creek, Pleasant District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (40')			
Sandstone, concealed, and shale, from summit of knob	40	40	40'
Allegheny Series (385')			
Sandstone, coarse, brown, conglomeratic, large quartz pebbles abundant, **Upper Freeport**	100	140	
Spring and concealed, **Lower Freeport Coal horizon**	10	150	
Fire clay shale, white	2	152	
Concealed	13	165	
Sandstone and concealed	35	200	
Sandstone, coarse, brown, medium-soft, slightly friable, large quartz pebbles abundant, **Lower Freeport**	50	250	210'
Concealed in bench, **Upper Kittanning**	15	265	
Sandstone, mostly concealed, **Upper East Lynn**	100	365	
Bench, **Middle Kittanning Coal horizon**	5	370	
Sandstone, **East Lynn**, and concealed	50	420	
Bench, **No. 5 Block Coal horizon**	5	425	175'
Pottsville Series—Kanawha Group (174')			
Concealed, steep slope	65	490	
Bench, **Stockton "A" Coal horizon**	5	495	
Sandstone	25	520	
Concealed, **Kanawha Black Flint horizon**, supplied from typical flint exposure 0.7 mile southeastward	10	530	105'
Concealed and sandstone	52	582	
Coal, splinty, bony 0' 7" Shale, dark-gray 0 5 **Coal**, splinty, slightly bony 2 3 Slate, dark-gray 0 3 **Coal**, bony 0 2 Fire clay shale, sandy 3 0 Sandstone, massive 1 3 Shale, flaggy, sandy 2 3 Shale, dark, argillaceous 1 0 **Coal**, gray splint, hard 1 10 **Coalburg** (1140' B.) (No. 893 on Map II)	13	595	65'
Slate and concealed to bed of Sycamore Creek	4	599	4'

On the head of Right Fork of Sycamore Creek, Gawthrop and the writer measured with aneroid the following section from the J. C. Stone opening in the Upper Kittanning Coal westward to a closed digging in the No. 5 Block bed on the opposite side of the hill road, the same starting about 60 feet below the base of the Conemaugh Series:

Section 1.3 Miles South of Lizemores, Pleasant District.

		Thickness. Feet.	Total. Feet.	
Allegheny Series (287')				
Sandstone, massive, very pebbly ....10' Concealed ....10 Sandstone, massive, coarse-grained, large pebbles.....10	Upper Freeport	30	30	
Concealed to road fork..........		25	55	
Concealed and shale..........		65	120	
Coal, gas...1' 2" **Coal, gas, harder..1 5**	**(J. C. Stone Opening)** **Upper Kittanning (2' 7").** (1340' B.)	2.6	122.6	122.6'
Shale and concealed..........		5.4	128	
Sandstone, massive, gray, hard..........		15	143	
Concealed		144	287	
Coal, No. 5 Block, at digging, thickness concealed, (1175' B.)..........		...	287	164.4'

In the western edge of the same District, the following succession is obtained by combining a section measured with aneroid by the writer with the detailed log of the Elk River Lumber Company No. 2 Well (133 on Map II). That portion above the well was determined on the north hillside of Lick Branch, immediately northeast of the boring in question. This well is located 0.3 mile up Lick Branch of Adonijah Fork and was completed March 1, 1910. H. B. Davenport of Clay, West Virginia, is the authority for the very complete record, the details of which were obtained by an extra man kept on the job for that purpose alone during drilling operations:

Lick Branch of Adonijah Section, Pleasant District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (190')			
Unrecorded and concealed in gentle slope from top of knob..........	100	100	
Concealed in gentle slope and shale..........	90	190	190'
Allegheny Series (335')			
Sandstone, coarse, brown, pebbly, **Upper Freeport**	25	215	
Bench, concealed..........	10	225	
Sandstone, coarse, brown..........	90	315	
Bench	5	320	
Concealed, steep slope..........	40	360	
Bench, **Upper Kittanning**..........	5	365	175'
Concealed, steep slope..........	35	400	
Bench	5	405	

	Thickness. Feet.	Total. Feet.	
Concealed, steep slope, mostly sandstone, **Upper East Lynn**	70	475	
Bench, slight	5	480	
Concealed, steep slope	15	495	
Sandstone, grayish-white, current-bedded, making cliff, **East Lynn**	28	523	
Coal, gas, hard........1' 6" **Coal, slaty**.............0 6 } **"No. 5 Block"**	2	525	160'
Pottsville Series (1561')			
Shale and concealed	45	570	
Bench	5	575	
Concealed, steep slope	65	640	
Sandstone, massive	8	648	
Coal, at digging, closed, reported thin, Stockton "A"	2	650	125'
Concealed to top of boring (133 on Map II) (905' B.)	20	670	
Continued with Log of Elk River Lumber Co. Well No. 2 (No. 133 on Map II):			
Clay and gravel from well mouth	23	693	
Slate	2	695	
Coal and slate, Stockton	5	700	50'
Shale	15	715	
Coal, Coalburg	5	720	20'
Sandstone, (water at 55' from top of hole)	125	845	
Coal, Chilton?	5	850	130'
Slate	15	865	
Coal, Hernshaw?	5	870	20'
Slate	20	890	
Clay	15	905	
Lime	15	920	
Slate	15	935	
Lime	15	950	
Sandstone, broken	10	960	
Slate	20	980	
Lime	15	995	
Sandstone	30	1025	
Coal, No. 2 Gas?	5	1030	160'
Slate	60	1090	
Lime	20	1110	
Slate	10	1120	
Lime	30	1150	
Slate	50	1200	
Sandstone, broken	15	1215	
Slate	55	1270	
Lime	14	1284	
Sand, "Gas" of Rosedale, (gas at 614'; oil show at 620' from top of hole)	26	1310	
Lime	10	1320	
Sandstone, **Lower Gilbert?**	70	1390	
Slate	50	1440	410'
Sand, (hard from 770'-810' from top of hole)	65	1505	
Lime, sandy	15	1520	
Sand	80	1600	
Slate, black	30	1630	

		Thickness. Feet.	Total. Feet.	
Lime, sandy		20	1650	210'
Sand, close. 30'	**Salt of Rosedale** (water at 1070'; big water at 1085'; more water at 1115'; filled up 750').	150	1800	
Sand, hard. 40				
Sand, soft. 80				
Lime, sandy		40	1840	
Sand, soft 20'	**Salt Sand**	68	1908	258'
Sand, hard 20				
Sand, limy 15				
Sand, soft 10				
Sand, close, **little gas** 3				
Lime, sandy		27	1935	
Sand, hard, and fine-grained		19	1954	
Lime, sandy		26	1980	
Lime, sandy, hard		33	2013	
Sand, fine		12	2025	
Sand, pebbly 15'	**Salt** (bottom).	20	2045	
Sand, gray 5				
Slate, black		10	2055	
Slate, gray		5	2060	
Lime		10	2070	
Lime, dark, sandy		6	2076	
Sand, pebbly		10	2086	178'
Mauch Chunk Series (272')				
Lime		9	2095	
Slate shells		13	2108	
Red rock		5	2113	
Lime		6	2119	
Red shale and lime		11	2130	
Red rock		3	2133	
Shale		12	2145	59'
Sand, gray 15'	**Maxton**	45	2190	
Sand, dark 25				
Sand, limy 5				
Slate and shale		13	2203	
Shale, pink, and lime		15	2218	
Lime shells		2	2220	
Shale, red		6	2226	
Shale, red, and lime		16	2242	
Lime, dark-red		8	2250	
Slate, bluish-gray		8	2258	
Slate, black		6	2264	
Slate, dark-gray		7	2271	
Cave		10	2281	
Lime, dark-brown		33	2314	
Lime, dark-gray		13	2327	
Lime, sandy		6	2333	
Lime, soft, velvety		6	2339	
Sand, pebbly 10'	**"Blue Monday"**	14	2353	
Sand, hard 4				
Pencil Cave		5	2358	213'

			Thickness. Feet.	Total. Feet.	
Greenbrier Limestone (136')					
Lime, dark	12'	Big Lime	136	2494	136'
Lime, dark-brown	8				
Lime, white	10				
Lime, gray	28				
Lime, white	12				
Lime, brown	17				
Lime, gray, sandy	3				
Lime, brown	12				
Lime, gray and gritty	7				
Lime, brown	11				
Lime, brown and gritty	6				
Lime, gray and gritty	5				
Lime, gray, sandy	5				
Pocono Sandstones (452')					
Sand, Keener (oil show)			5	2499	
Lime, white			14	2513	
Sand, light-yellow	2'	Big Injun	60	2573	
Sand, blue-gray	5				
Sand, close, white	3				
Sand, white, very hard	3				
Sand, yellow and hard	2				
Sand, white, very hard	1.5				
Sand, close, white	1.5				
Sand, white and pebbly	4				
Sand, close and pebbly	4				
Sand, white and glassy	7				
Sand, extra-close, very white	2				
Sand, brown and softer (gas show)	4				
Sand, dark-gray	5				
Sand, very dark (oil show)	5				
Sand, black, large pebbles	11				
(This sand from 1877-1902' below top of hole was very soft and porous).					
Red rock			28	2601	
Lime			10	2611	
Lime and shells			20	2631	
Shale, black			40	2671	
Lime, sandy			10	2681	
Lime, gritty			20	2701	
Slate, gray			47	2748	
Slate, dark, and shale			15	2763	
Slate			36	2799	
Shale			20	2819	
Shale, sandy			10	2829	
Slate			18	2847	
Shale, sandy, and black slate			9	2856	
Slate, gray and black, and shells			20	2876	
Slate, gray, and shells			15	2891	
Slate, black and lime			20	2911	
Slate, gray, and shells			35	2946	452'
Devonian—Catskill Series (144')					
Slate, black, and shells			15	2961	
Slate, gray and black, and shells			15	2976	
Slate, gray, and shells			15	2991	

	Thickness. Feet.	Total. Feet.	
Shale, gray	8	2999	
Shells, gray and sandy	6	3005	
Shale, gray and gritty	22	3027	
Shell, very hard and sandy	6	3033	
Shale, sandy (show of oil, scum, and very strong oil smell), Fifty-foot?	12	3045	
Shale, gray, sandy	30	3075	
Slate, gray	5	3080	
Shale, gray, gritty, to bottom of hole	10	3090	144'

The following succession, obtained by the writer just across the line from Pleasant District in the edge of Nicholas County and published on page 462 of Volume II(A) of the Survey Reports, represents a section measured with aneroid combined with the logs of two core drill tests in the immediate region, the details of which were furnished by J. R. Sharp:

Greendale Section, Nicholas County.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (195.5')			
Sandstone, coarse, brown, capping hill..........25' Sandstone, massive, making great cliffs............65' } Upper East Lynn	90	90	
Coal, Middle Kittanning, visible 6"	0.5	90.5	
Concealed and massive sandstone	105	195.5	
Coal blossom, "No. 5 Block"	...	195.5	195.5'
Pottsville Series (684.4')			
Concealed	45	240.5	
Kanawha Black Flint	3	243.5	48'
Concealed	88	331.5	
Slate	1.7	333.2	
Slate with streak of coal	0.3	333.5	
Coal, hard splint.1' 9" Bone coal.........0 1 Coal, gas, 4" to..0 6 Coal, splint......1 2 } Coalburg at old "Raven Mine"	3.5	337	93.5'
Shale and concealed	40	377	
Coal, Winifrede	1.5	378.5	41.5'
Shale	8	386.5	
Coal, concealed, and massive sandstone	205.5	592	
Coal, Williamson?, visible 8"	0.7	592.7	214.2'
Shale	40	632.7	
Sandstone, mostly, Upper Cedar Grove	15	647.7	
Coal, Cedar Grove, "Thacker"	1.5	649.2	56.5'
Sandstone, mostly, partly concealed	104	753.2	
Coal, gas.....3' 2" Shale ....0 4 Coal, gas......0 8 } Campbell Creek "No. 2 Gas"	4.2	757.4	108.2'
Sandstone, mostly, partly concealed	120	877.4	
Coal, Eagle	2.5	879.9	122.5'

In the foregoing section there are some slight changes and additions from that as originally published in Volume II(A). The Thacker Coal correlates with the Cedar Grove bed as shown on pages 170-2 of the Logan-Mingo County Report, published in 1914.

Union District (Clay) Sections.

Union occupies the western point of Clay County so that the surface rocks belong in the Conemaugh, Allegheny, and Pottsville Series exclusively. The following section was measured with hand-level by the writer on the north hillside of Elk River, directly opposite the mouth of Queen Shoals Creek. The results are only slightly less than they should be, since the total northwest dip between the two extremes is not over 15 to 20 feet:

Queen Shoals Section, Union District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (258')			
Sandstone, massive, coarse, brown, pebbly, **Upper Freeport**, visible	14	14	
Concealed	1	15	
Iron ore, lenses, Lower Freeport	0.5	15.5	15.5'
Concealed in bench	4.5	20	
Sandstone, coarse, brown, pebbly ....23' Concealed in slope.... 7 Sandstone, coarse, brown, pebbly ....40 } **Lower Freeport**	70	90	
Concealed and shale	6	96	
Coal, "Queen Shoals," Upper Kittanning (819' L.)	4	100	84.5'
Sandstone, grayish-white, pebbly, **Upper East Lynn**	20	120	
Concealed in steep slope	25	145	45'
Fire clay shale, **Middle Kittanning Coal** horizon at top	4	149	
Sandstone, platy, grayish-white, making cliff, **East Lynn**	41	190	
Concealed in steep slope, mostly sandstone..	61	251	
Coal, at closed digging, blocky, "**No. 5 Block**"? reported	2	253	108'
Concealed	5	258	
Pottsville Series—Kanawha Group (57')			
Sandstone, grayish-white, making cliff, **Homewood**	30	288	

				Thickness. Feet.	Total. Feet.	
Concealed				12	300	
Kanawha Black Flint, typical, (614' L.)				5	305	52'
Shale				1	306	
Coal, medium-hard	0'	9"	**Stockton** (No. 807 on Map II).	3.3	309.3	
Shale and slate	1	0				
Coal, splint	1	6				
Concealed to Elk River, opposite mouth of Queen Shoals Creek				5.7	315	10'

On the north side of Elk River in the same District, Gawthrop measured with aneroid the following section down the north hillside of the latter stream, 0.2 mile above the mouth of Upper King Shoals Run:

Section Opposite King, Union District.

				Thickness. Feet.	Total. Feet.	
Conemaugh Series (130')						
Concealed in steep slope				70	70	
Bench				...	70	
Concealed, gentle slope				60	130	130'
Allegheny Series (320')						
Bench, top of **Upper Freeport Sandstone** (1000' B.)				...	130	
Concealed				100	230	
Sandstone, massive, medium coarse-grained, brown				10	240	
Concealed				22	262	
Sandstone, massive, coarse-grained, brown				15	277	
Coal	0'	3"	**Upper Kittanning** (845' B.) **(Opening No. 486 on Map II).**	3.1	280.1	150.1'
Shale, gray	0	5				
Coal, semi-splint	1	0				
Coal, gas, hard	1	5				
Slate and concealed				24.9	305	
Sandstone, massive				10	315	
Concealed				20	335	
Sandstone, massive, gray, medium-grained, hard				55	390	
Concealed, with sandstone				30	420	
Sandstone, massive				30	450	169.9'

In the same District, the writer measured the following section eastward from the summit of a high knob on the south side of Elk to the bed of the River at the mouth of Toms Hollow:

Section 0.4 Mile Southwest of Camp, Union District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (75')			
Sandstone, massive, coarse-grained, brown, not pebbly, **Lower Mahoning**	45	45	
Bench, flat	30	75	75'
Allegheny Series (275')			
Sandstone, massive, coarse-grained, brown, conglomeratic, large quartz pebbles, **Upper Freeport**	85	160	
Concealed	10	170	
Sandstone, massive, coarse-grained, brown, small pebbles at base, **Lower Freeport**	45	215	
Bench, flat, **Upper Kittanning Coal horizon** (930' B.)	10	225	150'
Concealed, mostly greenish sandstone in steep slope	65	290	
Bench	5	295	
Concealed, steep slope	50	345	
Bench, **with coal blossom, "No. 5 Block"**	5	350	125'
Pottsville Series (185')			
Sandstone, making cliff, **Homewood**	70	420	
Concealed	20	440	
Bench, **Coalburg**	5	445	
Sandstone, **Lower Coalburg**	50	495	
Concealed to Coal & Coke Ry. grade (650' B.)	10	505	155'
Concealed to **Elk River**	30	535	30'

In the same District, on the north side of the River, the following section was measured by the writer mostly along the hill road leading southwest to the mouth of Dulls Creek via an opening in the Coalburg Coal on the land of Samuel Samples on the east bank of the latter stream, about one-eighth mile above its mouth. The results above the coal last mentioned are much less than they should be, owing to the rapid northeast dip of the strata here down a nose of the Chestnut Ridge Anticline:

Section at Procious, Union District.

	Thickness. Feet.	Total. Feet.
Allegheny and Pottsville Series (420')		
Sandstone, conglomeratic, **Upper Freeport**	85	85
Concealed	15	100
Sandstone, grayish-white, partly concealed	90	190
Concealed and spring	15	205
Concealed	5	210
Sandstone and concealed	85	295
Sandstone, grayish-white	40	335

				Thickness. Feet.	Total. Feet.	
Concealed				10	345	
Sandstone, with shale layers				3.3	348.3	
Coal, slaty	0'	4"				
Slate, dark, sandy	1	0				
Coal, bony	0	4				
Shale, dark-gray	0	3				
Coal, semi-splint	0	7	**Coalburg** (**Samuel Samples Opening**) (690' B.) (6' 8") (No. 915 on Map II)	6.7	355	355'
Shale, dark, with thin coal streaks	2	0				
Coal, splint	1	7½				
Shale, gray, ¼" to	0	0½				
Coal, splint	0	6				
Slate and concealed to Elk River, mouth of Dulls Creek				65	420	65'

The following succession is obtained by combining a section measured with aneroid by the writer with the log of the Harvey Samples No. 2 Well—No. 140 on Map II. That portion above the well mouth was determined down the steep south hillside of Elk River, opposite the boring in question, the latter being located on the north bank of the River, 1 mile south of Procious. This well was completed on October 25th, 1915, by the Samples Oil Company and its record furnished the Survey by L. G. Davis:

Section 0.7 Mile West of Marne, Union District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (25')			
Concealed and shale from top of knob	25	25	25'
Allegheny Series (280')			
Sandstone, coarse, brown, conglomeratic, large quartz pebbles, **Upper Freeport**	70	95	
Concealed and shale, with iron ore	20	115	
Sandstone, flaggy, green	40	155	
Concealed, horizon of **Upper Kittanning Coal**	5	160	135'
Sandstone, **Upper East Lynn**, grayish-white, conglomeratic, mostly concealed	60	220	
Bench, **Middle Kittanning Coal horizon**	5	225	
Concealed, mostly sandstone, in steep slope	75	300	
Bench	5	305	
Coal blossom, "No. 5 Block," (800' B.)	...	305	145'
Pottsville Series (1267')			
Sandstone, grayish-white, platy, **Homewood**	30	335	
Bench, concealed	5	340	
Sandstone, grayish-white, platy, making great cliff, **Homewood**	35	375	
Concealed, steep slope	45	420	
Sandstone	15	435	

	Thickness. Feet.	Total. Feet.	
Concealed	5.3	440.3	
Coal, visible 20", Coalburg	1.7	442	137'
Shale to Coal & Coke Ry. grade opposite Harvey Samples No. 2 Well (No. 140 on Map II)	3	445	
(Continued with Log of Samples Well):			
Soil, etc	90	535	
Sand	10	545	
Slate, etc	25	570	
Coal, Chilton?	3	573	131'
Slate, etc	12	585	
Sand	10	595	
Slate	3	598	
Coal, Williamson?	2	600	27'
Slate, etc	20	620	
Sand	10	630	
Slate and shells	260	890	
Sand	15	905	
Slate and lime	100	1005	
Gas Sand (salt water)	150	1155	
Slate and lime	45	1200	
Salt Sand	200	1400	
Slate break	5	1405	
Salt Sand	67	1472	
Slate	30	1502	
Lime	35	1537	
Sand	35	1572	972'
Mauch Chunk Series (209')			
Red rock	20	1592	
Lime	53	1645	
Slate and shells	32	1677	
Maxton Sand	40	1717	
Little Lime	30	1747	
Pencil Cave	34	1781	209'
Greenbrier Limestone (92')			
Big Lime (gas show at 1388')	92	1873	92'
Pocono Sandstones (106')			
Keener Sand (few inches slate break at 1459')	31	1904	
Big Injun Sand (gas show at 1468')	63	1967	
Slate	6	1973	
Red rock to bottom	6	1979	106'

"The Big Injun Sand from 1496' to 1518' showed oil, with gas at the top; viz, 1496' to 1499'. Well should be shot from 1496' to 1518'. Later shot and showed for 4 to 5 barrels oil daily from Big Injun Casing record: 10" casing, 61'; 8¼" casing, 400'; and 6⅝" casing, 1336'."

On the north side of the river in the same District, the following section was measured by the writer on the opposite hillside of Elk from Marne Station, 0.2 mile west of the mouth Twistabout Creek:

Section Opposite Marne, Union District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (310')			
Concealed, steep slope, mostly sandstone from top of ridge	25	25	
Sandstone, coarse-grained, brown, conglomeratic, large quartz pebbles, **Upper Freeport**	40	65	
Bench and concealed, **Lower Freeport Coal horizon**	20	85	
Sandstone, coarse-grained, brown, current-bedded, making great cliff, **Lower Freeport**	60	145	145'
Concealed	65	210	
Bench, **Upper Kittanning Coal horizon**	10	220	
Sandstone, **East Lynn**	86	306	
Coal, gas, hard..1' 10" Slate, black.....0 6 **Coal, splint**......1 8 "**No. 5 Block**" at Opening (No. 728 on Map II) (770' B.)	4	310	165'
Pottsville Series—Kanawha Group (145')			
Sandstone, grayish-white, making great cliff, **Homewood**	75	385	
Concealed	39	424	
Kanawha Black Flint, in situ?	1	425	115'
Concealed to Elk River (630' B.)	30	455	30'

In the eastern edge of Union District (Clay), the following section was measured with aneroid by the writer southeastward along the hill road to the bed of Upper Birch Run, including a determination at an opening in the Coalburg Coal on the west bank of the latter stream, just above Birch Station on the Coal & Coke Railway. The results are less than they should be, owing to the rise of the strata to the east:

Section at Birch, Union District.

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (85') ,			
Sandstone, coarse, brown, friable, pebbly, **Upper Mahoning**	35	35	
Shale, concealed, and shale	50	85	85
Allegheny Series (295')			
Sandstone, coarse-grained, pebbly, brown, **Upper Freeport**	20	105	
Fire clay	1	106	
Shale, concealed, and shale	44	150	
Coal, slaty, **Lower Freeport** (1060' B.)	0.4	150.4	65.4'
Shale	9.6	160	
Iron ore (6"), Lower Freeport	0.5	160.5	
Shale, sandy, brown	19.5	180	
Sandstone, coarse, brown, **Lower Freeport**	65	245	

	Thickness. Feet.	Total. Feet.	
Concealed, bench, **Upper Kittanning Coal horizon**	5	250	99.6'
Sandstone, **Upper East Lynn**	20	270	
Concealed	15	285	
Sandstone, mostly concealed	45	330	
Sandstone, grayish-white, making cliff, **East Lynn**	50	380	130'
Pottsville Series (178')			
Concealed, steep slope	60	440	
Coal prospect, Stockton "A," closed, (775' B.)	...	440	60'
Concealed, holding **Kanawha Black Flint** and **Stockton Coal** near base	72.2	512.2	
Sandstone, grayish-white and brown, platy, **Upper Coalburg**	20	532.2	
Coal, bony, 6" to 0' 8" Shale, gray, argillaceous 4 0 **Coal**, bony 0 8 **Coal**, splint, hard 2 1 Slate and concealed 3 0 Slate, black, siliceous 1 3 **Coal**, splinty 1 2 **Coalburg**... (12' 10") (670' B.) (No. 909 on Map II)	12.8	545	105'
Slate, gray, and concealed, to bed of Upper Birch Run	13	558	13'

Slightly less than 3 miles northwestward in the same District, Gawthrop and the writer measured with aneroid the following section southwestward along the second-class road to the bed of Porter Creek, closely on the strike of the rocks, including a section of the No. 5 Block Coal at a digging on the west side of the latter stream:

Section One Mile Northwest of Bomont, Union District.

	Thickness. Feet.	Total. Feet.	
Allegheny Series (315')			
Sandstone, massive, coarse, grayish-brown, conglomeratic, **Upper Freeport**	75	75	
Concealed	35	110	
Sandstone, partly concealed, **Lower Freeport**	25	135	
Concealed	50	185	
Coal, at closed prospect, on bench, **Upper Kittanning** (930' B.)	...	185	185'
Concealed	55	240	
Sandstone, grayish-white, **Upper East Lynn**, and concealed	72.5	312.5	
Coal 1 10" Slate, black, hard 0 5 **Coal** 1 0 **"No. 5 Block,"** at closed prospect (800' B.) (Section by E. M. Williams) (3'-3")	2.5	315	130'
Pottsville Series (50')			
Sandstone, **Homewood**, to bed of Porter Creek, just below road fork	50	365	50'

The following very complete section is obtained from the detailed log of the **M. J. King and E. W. King No. 6 Well—No. 169 on Map II,** one mile due east of Bomont, on the south edge of the ridge road—the details of which were kindly furnished the Survey by the owner, the Ohio Fuel Oil Company. This well is located near the eastern edge of the present developed Big Injun Sand oil pool and was completed March 15, 1913:

Section One Mile Due East of Bomont, Union District. (Log of the M. J. and E. W. King No. 6—169 on Map II).

(Elevation, 1202' L.)

	Thickness. Feet.	Total. Feet.	
Conemaugh Series (110')			
Clay	19	19	
Sand, Upper Mahoning	20	39	
Slate	38	77	
Sand, Lower Mahoning	33	110	110'
Allegheny Series (357')			
Slate and lime	65	175	
Sand, Lower Freeport	100	275	
Coal, Upper Kittanning (923' L.)	4	279	169'
Sand, Upper East Lynn	11	290	
Slate	35	325	
Sand, East Lynn	140	465	
Coal, "No. 5 Block," (735' L.)	2	467	188'
Pottsville Series—Kanawha Group (777')			
Sand, Homewood	63	530	
Slate and lime	27	557	
Coal, Stockton and Coalburg (633' L.)	12	569	102'
Slate and lime	46	615	
Sand, Lower Winifrede?	60	675	
Slate and lime	43	718	
Coal, Chilton (480' L.)	4	722	153'
Slate and lime	378	1100	
Sand	33	1133	
Slate	14	1147	
Sand	88	1235	
Slate and lime	9	1244	522'
Pottsville Series—New River Group (431')			
Salt Sand, (water at 1336'), "Nuttall"	246	1490	
Slate and lime	7	1497	
Sand	125	1622	
Slate and lime	16	1638	
Sand	37	1675	431'
Mauch Chunk Series (261')			
Red rock	112	1787	
Maxton Sand (oil show at 1816')	37	1824	
Slate	20	1844	

	Thickness. Feet.	Total. Feet.	
Little Lime	25	1869	
Slate	25	1894	
Lime	25	1919	
Pencil Cave	17	1936	261'
Greenbrier Limestone (114')			
Big Lime (gas at 2006' and 2024')	114	2050	114'
Pocono Sandstone Series (69')			
Keener Sand (oil show at 2072')	37	2087	
Big Injun Sand (oil pay at 2087')	20	2107	
Unrecorded to bottom	12	2119	69'

"Casing record: 10" casing, 19'; 8¼" casing, 655'; 6⅝" casing, 1638'; and $5\frac{3}{16}$" casing, 1939'. Big Injun Sand oil producer; initial production, 5 barrels daily and still making 3 in October, 1915."

SUMMARY.

For the convenience of reference the following table has been compiled from the sections on preceding pages of this Chapter. It shows at a glance not only the three main divisions—Pennsylvanian, Mississippian, and Devonian—of the stratified rocks outcropping or penetrated by many test borings for coal, oil, and gas, but, in most instances, that for their subdivisions or series. A line of dots under the latter indicates that the formation was not exposed, measured, or penetrated by boring, if the latter is used in section; and a question mark (?), that the series was present but could not be separated from the formation either overlying or underlying it. Frequently, thicknesses are either too great or too little, owing to the dip of the strata prevailing where the results were obtained. An explanation accompanies each section, giving the peculiar conditions under which the results were obtained:

Table Showing Thickness in Feet of the Stratified Rocks in Braxton and Clay Counties.

Place Measured.	PENNSYLVANIAN.						MISSISSIPPIAN.				DEVONIAN.			Total Section.
	Dunkard.	Monongahela.	Conemaugh.	Allegheny.	Pottsville.	Total.	Mauch Chunk.	Greenbrier Limestone.	Pocono Sandstones.	Total.	Catskill.	Chemung.	Total.	
Bablin			135	195	811	1141	344	230	181	755	594	244	838	2734
Barton, 1.5 mi. S. E.			40	245		285								285
Beech Fork of Lilly				285	1093.1	1378.1								1378.1
Berry Siding, 0.6 mi. N.		195	380			575								575
Big Otter, 0.5 mi. S. E.		220	605	258	1106	2189	150	126	400	676	296		296	3161
Birch			85	295	178	558								558
Bomont, 1 mi. N. W.				315	50	365								365
Bomont, 1 mi. due E.			110	357	1208	1675	261	114	69	444				2119
Braxton, 1 mi. N. W.		200	110			310								310
Braxton, 1 mi. N.		425				425								425
Buckeye Creek			105	70.		175								175
Bulltown		45	500			545								545
Burnsville	135	340	(?)	(?)	(?)	2134	210	40	317	567	290		290	2991
Burnsville, 1.5 mi. N. W.	215	350	140			705								705
Burnsville, 1.2 mi. E.			134			134								134
Camp, 0.4 mi. S. W.			75	275	185	535								535
Centralia			60	250	1125	1435	455	100	430	985	572	956	1528	3948
Centralia, 3.5 mi. E.			(?)	(?)	900	1310								1310
Clay			285	330	1515	2130	240	170	425	835	370		370	3335
Cleveland			100	260	845	1205	575	165	425	1165	257		257	2627
Cove Hollow School, 1.7 mi. E.				165	295	460								460
Cove Hollow School, 2 mi. S. 10° W.				249.5	150.5	400								400
Cressmont			45	355	280	680								680
Dessie, 1.1 mi. N.		205	145			350								350
Dorfee			15	340.6	275.7	631.3								631.3
Dundon			85	360	135	580								580
Eakle, 0.7 mi. S. E.				315		315								315
Erbacon			40	315	425	780								780
Fairbanks, 0.2 mi. N.		200	160			360								360

Table Showing Thickness in Feet of the Stratified Rocks in Braxton and Clay Counties.—(Continued).

Place Measured.	PENNSYLVANIAN.						MISSISSIPPIAN.				DEVONIAN.			Total Section.
	Dunkard.	Monongahela.	Conemaugh.	Allegheny.	Pottsville.	Total.	Mauch Chunk.	Greenbrier Limestone.	Pocono Sandstones.	Total.	Catskill.	Chemung.	Total.	
Falls Mill	....	....	....	166	....	166	....	....	....	....	....	....	....	166
Flatwoods, 0.5 mi. S. W.	....	300	235	....	....	535	....	....	....	....	....	....	....	535
Frametown, 0.7 mi. N. E.	....	....	88	15	....	103	....	....	....	....	....	....	....	103
Frametown—Eli Taylor Knob	....	175	602	36	....	813	....	....	....	....	....	....	....	813
Gassaway, N. W. edge	....	275	545	....	....	820	....	....	....	....	....	....	....	820
Gassaway, 2 mi. W.	....	....	267	....	....	267	....	....	....	....	....	....	....	267
Gassaway, 2¼ mi. S.	....	....	370	....	....	370	....	....	....	....	....	....	....	370
German, 1 mi. S. E.	....	....	160	....	....	160	....	....	....	....	....	....	....	160
Gillespie, 1 mi. N. W.	....	....	....	257	103	360	....	....	....	....	....	....	....	360
Glendon	....	....	....	231	....	231	....	....	....	....	....	....	....	231
Gravel Fork of Laurel	....	....	....	220	90	310	....	....	....	....	....	....	....	310
Greendale	....	....	....	195.5	684.4	879.9	....	....	....	....	....	....	....	879.9
Gregory	....	....	275	255	155	685	....	....	....	....	....	....	....	685
Groves, 0.6 mi. S. W.	....	....	....	297.5	72.5	370	....	....	....	....	....	....	....	370
Groves, 1 mi. S. 15° W.	....	....	....	330	85	415	....	....	....	....	....	....	....	415
Groves, 1.2 mi. S. E.	....	....	....	320	....	320	....	....	....	....	....	....	....	320
Harrison, ¼ mi. W.	....	....	105	165	....	270	....	....	....	....	....	....	....	270
Harrison, 1.6 mi. due E.	....	....	....	255	....	255	....	....	....	....	....	....	....	255
Herold, N. E. edge	....	....	290	270	55	615	....	....	....	....	....	....	....	615
Herold. S. edge	....	....	....	224.2	50	274.2	....	....	....	....	....	....	....	274.2
High Knob	....	....	340	....	....	340	....	....	....	....	....	....	....	340
Holly, ¼ mi. S. W.	....	....	60	290	310	660	....	....	....	....	....	....	....	660
Holly, 0.8 mi. S. W.	....	....	....	....	57.1	57.1	....	....	....	....	....	....	....	57.1
Holly, 1.3 mi. S. W.	....	....	....	....	83	83	....	....	....	....	....	....	....	83
Ivydale	....	....	40	272	118	430	....	....	....	....	....	....	....	430
Ivydale, 0.5 mi. S. W.	....	....	180	320	150	650	....	....	....	....	....	....	....	650
Ivydale, 1 mi. due S.	....	....	....	25	147	172	....	....	....	....	....	....	....	172
Jennings, ⅛ mi. W.	....	....	170	290	....	460	....	....	....	....	....	....	....	460
Jennings, 0.4 mi. S. E.	....	....	90	295	....	385	....	....	....	....	....	....	....	385

Table Showing Thickness in Feet of the Stratified Rocks in Braxton and Clay Counties.—(Continued).

Place Measured.	PENNSYLVANIAN.						MISSISSIPPIAN.				DEVONIAN.			Total Section.
	Dunkard.	Monongahela.	Conemaugh.	Allegheny.	Pottsville.	Total.	Mauch Chunk.	Greenbrier Limestone.	Pocono Sandstones.	Total.	Catskill.	Chemung.	Total.	
Jennings, 2 mi. S. E	....	....	....	220	115	335	......	......	......	......	......	......	......	335
King	....	....	130	320	......	450	......	......	......	......	......	......	......	450
Knawl, 0.3 mi. S. E	....	....	204	1	......	205	......	......	......	......	......	......	......	205
Knawl Creek, Head of	....	....	....	230	734	964	198	138	406	742	758	......	758	2464
Laurel Fork of Lilly	....	....	....	155	405	560	......	......	......	......	......	......	......	560
Lick Branch of Adonijah	....	....	190	335	1561	2086	272	136	452	860	144	......	144	3090
Little Birch, 1.3 mi. S. E	....	....	....	125	74.6	199.6	......	......	......	......	......	......	......	199.6
Lizemores, 1.3 mi. S	....	....	....	287	......	287	......	......	......	......	......	......	......	287
Lloydsville, 0.4 mi. N. W	....	345	135	.....	......	480	......	......	......	......	......	......	......	480
Mark	....	210	125	.....	......	335	......	......	......	......	......	......	......	335
Marne	....	....	....	310	145	455	......	......	......	......	......	......	......	455
Marne, 0.7 mi. W	....	....	25	280	1267	1572	209	92	106	407	......	......	......	1979
Marpleton	....	....	....	220	505	725	......	......	......	......	......	......	......	725
Mill Creek (Nicholas County)	....	....	....	320	......	320	......	......	......	......	......	......	......	320
Mill Run (Braxton), Head of	....	....	385	110	......	495	......	......	......	......	......	......	......	495
Morocco	....	....	110	385	185	680	......	......	......	......	......	......	......	680
Morocco, 2 mi. S	....	....	....	375	255	630	......	......	......	......	......	......	......	630
Napier, 1.6 mi. N	....	185	300	.....	......	485	......	......	......	......	......	......	......	485
Nebo, 1.5 mi. S. W	....	185	110	.....	......	295	......	......	......	......	......	......	......	295
O'Brien Creek, Mouth of	....	....	....	300	15	315	......	......	......	......	......	......	......	315
Orlando	....	338	610	(?)	(?)	1688	180	70	325	575	370	......	370	2633
Palmer	....	....	60	270	285	615	......	......	......	......	......	......	......	615
Pilot Knob	....	165	505	.....	......	670	......	......	......	......	......	......	......	670
Plum Run, Groves Creek	....	....	....	175	......	175	......	......	......	......	......	......	......	175
Polemic, Run, Mouth of	....	....	245	295	60	600	......	......	......	......	......	......	......	600
Procious	....	....	....	(?)	(?)	420	......	......	......	......	......	......	......	420
Queen Shoals	....	....	....	258	57	315	......	......	......	......	......	......	......	315
Root Fork of Groves Creek	....	....	....	197.8	......	197.8	......	......	......	......	......	......	......	197.8
Rosedale	....	380	654	250	782	2066	72	......	......	72	......	......	......	2138

Table Showing Thickness in Feet of the Stratified Rocks in Braxton and Clay Counties.—(Continued).

Place Measured.	PENNSYLVANIAN.						MISSISSIPPIAN.				DEVONIAN.			Total Section.
	Dunkard.	Monongahela.	Conemaugh.	Allegheny.	Pottsville.	Total.	Mauch Chunk.	Greenbrier Limestone.	Pocono Sandstones.	Total.	Catskill.	Chemung.	Total.	
Sand Fork, 0.5 mi. N. E.	....	....	....	(?)	(?)	505	......	......	......	......	......	......	......	505
Sand Fork, 0.7 mi. S. W.	....	....	(?)	(?)	205	670	......	......	......	......	......	......	......	670
Schoonover Knob, ¼ mi. N. E.	....	....	....	.....	190	190	......	......	......	......	......	......	......	190
Servia, 1.3 mi. S.	....	....	420	.....	......	420	......	......	......	......	......	......	......	420
Sinnett Br. of Lilly Fork	....	....	....	310	1521	1831	247	150	(?)	(?)	(?)	(?)	(?)	3657
Sleith, 1.7 mi. N. E.	....	180	637	260	950	2027	182	80	400	662	(?)	(?)	739	3428
Spread, ¼ mi. S. W.	....	....	....	217.7	50	267.7	......	......	......	......	......	......	......	267.7
Strange Creek	....	....	591	213.6	......	804.6	......	......	......	......	......	......	......	804.6
Strange Creek, 1 mi. N. W.	....	....	360	200	......	560	......	......	......	......	......	......	......	560
Sugar Knob	....	250	380	.....	......	630	......	......	......	......	......	......	......	630
Sutton	....	115	602.5	(?)	(?)	2085	90	70	(?)	(?)	(?)	(?)	(?)	3410
Sutton, 1 mi. N.	....	235	515	.....	......	750	......	......	......	......	......	......	......	750
Sutton, 3 mi. N.	....	445	145	.....	......	590	......	......	......	......	......	......	......	590
Sutton, 1 mi. N. W.	....	45	483	.....	......	528	......	......	......	......	......	......	......	528
Sutton, ½ mi. N. W.	....	....	455	.....	......	455	......	......	......	......	......	......	......	455
Sutton, S. W. edge	....	....	490	.....	......	490	......	......	......	......	......	......	......	490
Sutton, S. E. edge	....	....	545	.....	......	545	......	......	......	......	......	......	......	545
Sycamore Creek, Head of	....	....	40	385	174	599	......	......	......	......	......	......	......	599
Twistville—Diatter Run	....	....	680	287.7	17.5	985.2	......	......	......	......	......	......	......	985.2
Valley Fork P. O., 1 mi. S. W.	....	....	50	405	1200	1655	200	110	400	710	382	......	382	2747
Villa Nova, 1.3 mi. S.	....	....	....	315	......	315	......	......	......	......	......	......	......	315
Wallback	....	20	658	(?)	(?)	2060	140	130	(?)	(?)	(?)	(?)	(?)	3661
Wallowhole Knob	....	....	70	325	305	700	......	......	......	......	......	......	......	700
Wallowhole Knob, 2 mi. N. E.	....	....	....	305	320	625	......	......	......	......	......	......	......	625
Whetstone	....	....	....	307	......	307	......	......	......	......	......	......	......	307
Widen, N. edge	....	....	125	325	200	650	......	......	......	......	......	......	......	650
Widen, 3 mi. N. E.	....	....	60	340	1285	1685	370	85	109	564	......	......	......	2249
Widen, 1 mi. S. E.	....	....	85	355	110	550	......	......	......	......	......	......	......	550
Wildcat, N. edge	....	....	....	195	320	515	......	......	......	......	......	......	......	515
Wildcat, 1 mi. S. E.	....	....	....	185	......	185	......	......	......	......	......	......	......	185

CHAPTER V.

STRATIGRAPHY—DUNKARD AND MONONGAHELA SERIES.

GENERAL ACCOUNT, DUNKARD SERIES.

The Dunkard Series, as shown on Map II, is confined to the summits of the high hills and ridges in the northwest borders of Salt Lick and Otter Districts, Braxton County, probably less than 300 feet of the basal portion of the formation being preserved or only one-fourth the maximum development in West Virginia. These measures were first described by I. C. White[1] from their occurrence on Dunkard Creek, Greene County, Pennsylvania, who classed the same as of Permo-Carboniferous Age, representing a transitional stage between the true Permian and the Carboniferous. The Series has been described at length in previous County Reports of the State Survey, but for what is probably the most complete general section of these rocks yet published, the reader is referred to one covering the entire measures in Monongalia and Marion Counties[2].

With the exception of the alluvial deposits along the valley floors of the larger streams, these rocks are the most recent in formation, and, as represented in Braxton County, consist mainly of green to grayish-brown, micaceous, flaggy to massive sandstones, alternating with red and sandy shales, no limestone or coal being observed, although the **Washington bed** is probably present.

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[1] Bulletin 65, U. S. Geological Survey, p. 20; 1891.

[2] Ray V. Hennen, Monongalia-Marion-Taylor Report, W. Va. Geol. Survey, p. 165; 1913.

DESCRIPTION OF MEMBERS, DUNKARD SERIES.

THE WASHINGTON COAL.

The Washington Coal of White[3], belonging about 175 feet above the base of the Dunkard Series, was not observed at either prospect openings or crop exposure, but is no doubt present near the summits of the high knobs and ridges in the northwest borders of Salt Lick and Otter Districts (Braxton), where these show the presence on Map II of 200 feet and upwards of Dunkard Measures, since Reger[4] reports a prospect opening in this bed at an elevation of 1425′ B. on the north slope of Locust Knob in the edge of Gilmer County, 3 miles northwest of Burnsville. This digging was closed so that he was unable to determine its thickness and character. Owing to the small isolated areas of its probable occurrence and lack of information concerning it, this seam is not considered in this Report in estimating the available tonnage of minable coal for the two counties.

THE WASHINGTON FIRE CLAY SHALE.

The Washington Fire Clay Shale of Hennen[5], belonging immediately below the coal last described, was not observed by Gawthrop, who collected the data in the field on this portion of the Dunkard Series.

THE MANNINGTON SANDSTONE.

The Mannington Sandstone of Grimsley[6], belonging 20 to 40 feet below the Washington Coal and ranging in thickness from 30 to 50 feet, occurs high up near the summits of the hills and ridges where the latter hold 100 feet and upwards of

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[3] I. C. White, Annals of the Lyceum of Natural History, New York, Vol. XI, pp. 47-55; July, 1874—"Notes on the Upper Coal Measures of West Virginia and Pennsylvania," read May 25, 1874.

[4] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, p. 513; 1916.

[5] Ray V. Hennen, Wirt-Roane-Calhoun Report, W. Va. Geol. Survey, pp. 163-4; 1911.

[6] G. P. Grimsley, Vol. IV, W. Va. Geol. Survey, p. 440; 1909.

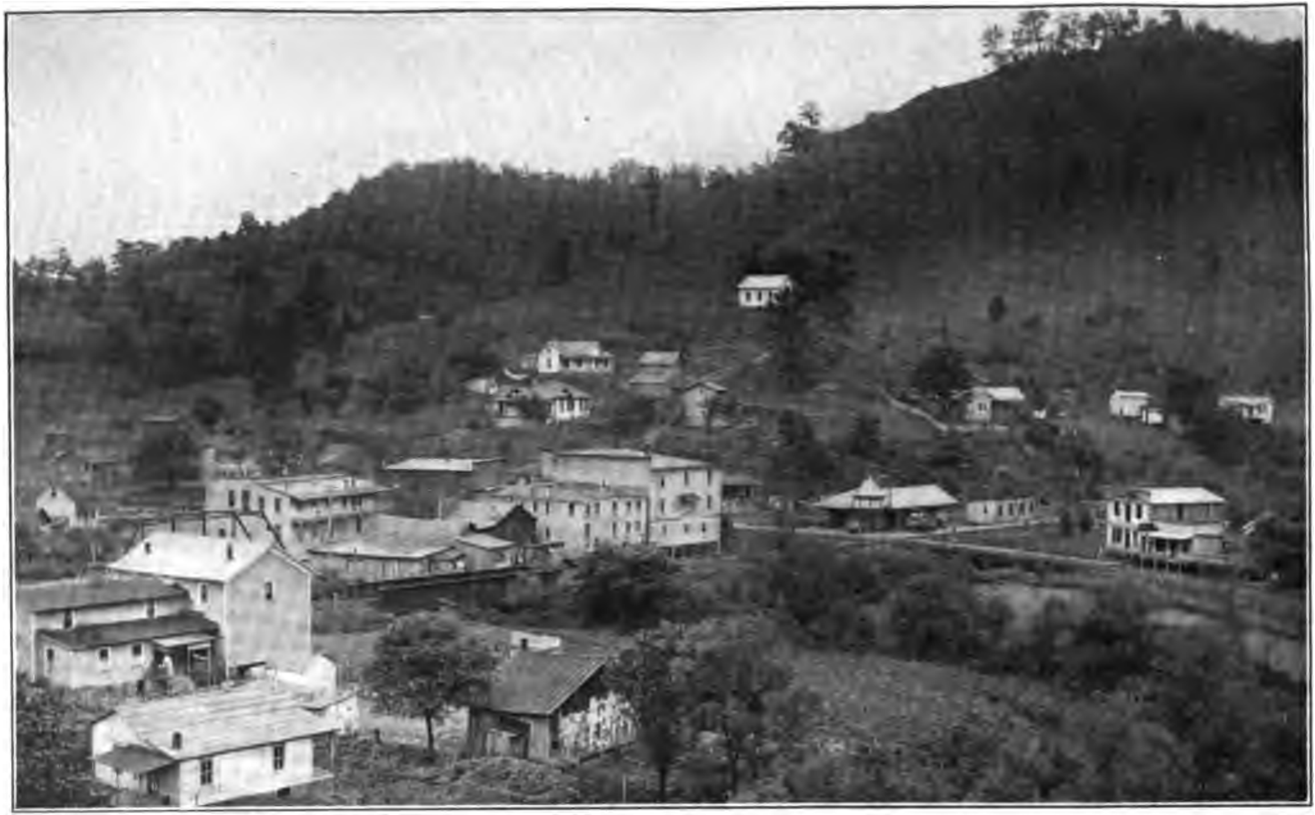

PLATE VII.—View of Orlando, showing junction of Baltimore & Ohio and Coal & Coke Railroads; Topography of the Monongahela and Conemaugh Series.

Dunkard Series as limited on Map II. It is generally massive, coarse to pebbly and grayish-brown in color, forming cliffs and steep bluffs around the hillsides. Its thickness and stratigraphic position are exhibited in the special sections in Chapter IV for Burnsville and Burnsville, 1.5 Miles Northwest, pages 47-8 and 43-4, respectively.

THE WAYNESBURG SANDSTONE.

The Waynesburg Sandstone, designated originally by the First Geological Survey of Pennsylvania from a town of that name in Greene County, Pennsylvania, and belonging practically at the base of the Dunkard Series, is present in normal development, being massive, coarse and pebbly and grayish-brown, frequently forming prominent escarpments around the hillsides in the regions of its occurrence and ranging in thickness from 40 to 60 feet. Its stratigraphic position is exhibited in the special sections in Chapter IV for Burnsville and Burnsville 1.5 Miles Northwest, and in the log of the L. W. McNair Heirs No. 2 Well (25 on Map II), the latter being located slightly less than 3 miles northwest of Burnsville in the edge of Gilmer County, 1 mile northeast of the mouth of Longshoal Run.

Since this stratum belongs at the base of the Dunkard Series, its outcrop is confined to the same region as that outlined on Map II for the junction line of the latter formation and the Monongahela Series. In the extreme northwestern edge of Otter District (Braxton), on the high point, ¾ mile northeast of the mouth of Piper Fork of Crooked Creek, Gawthrop reports this ledge in a massive and pebbly cliff, 50 feet in height, at an elevation of 1300′ B., 400 feet above the bench of the Pittsburgh Coal. No quarries were observed on it.

THE CASSVILLE PLANT SHALE.

The Cassville Plant Shale of White[7] and Fontaine was not definitely recognized in the territory of this Report. The apparent absence of the immediately underlying Waynesburg Coal and the large amount of talus usually concealing the entire interval of 15 to 20 feet separating the Waynesburg Sandstone from the Gilboy ledge below, combined to make the search for it by Gawthrop fruitless.

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[7] I. C. White, Vol. II, W. Va. Geol. Survey, pp. 119-123; 1903.

GENERAL ACCOUNT, MONONGAHELA SERIES.

The Monongahela Series of the Pennsylvanian, beginning at top with the Waynesburg Coal and extending down to and including the Pittsburgh bed, was first named and described by H. D. Rogers from its abundant outcrop along the Monongahela River in the State of Pennsylvania, and later by Jno. J. Stevenson, I. C. White, and others in the latter State and in West Virginia. It includes a large portion of the outcropping strata of the northwest halves of Salt Lick, Otter, and Birch Districts, Braxton County, and the northern half of Otter District (Clay). In other regions of the territory of this Report, the general southeastward rise of the rocks, as shown by the structure contours on Map II, elevates these measures above the summits of the highest hills.

The series has largely lost its calcareous character of western Pennsylvania and consists mainly of sandstone beds, both flaggy and massive, coarse- to medium-grained, micaceous, greenish- to grayish-brown in color, alternating with red and sandy shales and thin, siliceous limestones. Only one coal bed—the Pittsburgh—attains minable dimensions, the other important seams; viz, Waynesburg, Uniontown, Sewickley, and Redstone, of the northern portion of the State, are too thin and irregular to have any commercial importance. Taken as a whole, the formation lacks many of the economic features that have made the Monongahela Valley famous for its mineral wealth, although its thickness—about 400 feet—remains essentially the same.

The following general section, compiled from those published in Chapter IV and from numerous special observations, fairly represents the Monongahela Series in Braxton and Clay Counties:

General Section of the Monongahela Series in Braxton and Clay Counties.

	Thickness. Feet.	Total. Feet.	
Coal, Waynesburg, not seen			
Shale	5 to 10	10	
Sandstone, Gilboy	20 to 25	35	
Shale	10 to 15	50	
Sandstone, Uniontown, flaggy to massive, micaceous, green to gray	30 to 40	90	
Shale, Annabelle	5 to 8	98	
Coal, Uniontown	0 to 2	100	100'
Shale	2 to 4	104	
Limestone, Uniontown, shaly, impure	0 to 1	105	
Shale, red, with limestone nuggets	20 to 30	135	
Sandstone, Arnoldsburg, massive, coarse, sometimes pebbly, gray	25 to 40	175	
Coal, Lower Uniontown	0 to 1	176	76'
Shale, red, with limestone nuggets	20 to 24	200	
Sandstone, Sewickley, massive, coarse, very pebbly, gray, making great cliffs on outcrop	40 to 59	259	
Coal, Sewickley	0 to 1	260	84
Shale	5 to 5	265	
Sandstone, Lower Sewickley, massive to flaggy, gray	20 to 30	295	
Limestone, Sewickley, ferriferous, shaly and impure, reddish	0 to 2	297	
Shale	5 to 7	304	
Sandstone, Cedarville, massive, medium-grained, gray, forms steep bluffs and slopes	30 to 40	344	
Coal, Redstone	1 to 0	344	84'
Shale	0 to 5	349	
Sandstone, Weston, massive, gray	20 to 26	375	
Limestone, Redstone	0 to 5	380	
Shale, Weston	10 to 12	392	
Coal, Pittsburgh	0 to 8	400	56'

DESCRIPTION OF MEMBERS, MONONGAHELA SERIES.

THE WAYNESBURG COAL.

The Waynesburg Coal of H. D. Rogers, first named and described by the latter from the town of Waynesburg, Greene County, Pennsylvania, appears to be represented by only a few inches of black slate just below the base of the Waynesburg Sandstone, no coal having been observed at this horizon in either county. As mentioned on a preceding page under the description of the Cassville Plant Shale, its horizon is frequently concealed by talus, but its reported absence in the immediately adjoining Counties of Lewis and Gilmer by Reger[8] is corroborative evidence that it is not likely present in minable dimensions in the territory of this Report.

THE GILBOY SANDSTONE.

The Gilboy Sandstone of White[9], belonging 10 to 15 feet below the top of the Monongahela Series, is fairly persistent in Braxton County, where it forms steep slopes and sometimes cliffs high up on the hillsides wherever it outcrops. Its thickness and stratigraphic position are exhibited in the special sections in Chapter IV for Orlando, Burnsville, Rosedale, and Flatwoods—0.5 Mile Southwest. It varies in color from greenish-gray to grayish-brown, and in texture from medium- to coarse-grained, the latter type prevailing in the region in which the last-mentioned section was determined. No quarries were observed on it.

THE UNIONTOWN SANDSTONE.

The Uniontown Sandstone of White[10], belonging 60 to 70 feet below the top of the Monongahela Series and 5 to 10 feet above the Uniontown Coal, is generally present in northwestern Braxton wherever its horizon has not been eroded. It is usually micaceous and varies in texture from flaggy and medium-grained to massive and coarse, with small quartz pebbles, and in color from green to grayish-brown, its thickness ranging from 20 to 40 feet. Its character and stratigraphic position are exhibited in the special sections published in Chapter IV for Orlando, Burnsville, Braxton—1 Mile North, Sutton—3 Miles North, and Rosedale. No quarries were observed on this ledge in either county, but stone from it has been used successfully for bridge piers, abutments, and foundations in the northwest portion of the State.

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[8] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, p. 112; 1916.

[9] I. C. White, Vol. II, W. Va. Geol. Survey, p. 150; 1903.

[10] I. C. White, Bull. 65, U. S. Geol. Survey, p. 58; 1891.

THE ANNABELLE SHALE.

The Annabelle Shale, belonging immediately below the stratum last described and directly above the Uniontown Coal and designated from a town of that name in Marion County[11], was not observed in either county at the exposures visited, but its presence is indicated by a marked bench in the topography at the base of the Uniontown Sandstone.

THE UNIONTOWN COAL.

The Uniontown Coal, originally named and described by the First Geological Survey of Pennsylvania, appears to be lacking or very irregular in its deposition, as only one exposure of this bed was noted, Gawthrop collecting a sample for analysis and obtaining the following data at a country bank on it in the northwest edge of Otter District (Braxton):

Smith Marks Farm Mine—No. 1 on Map II.

On the head of Piper Fork, 0.6 mile northeast of Progress; Uniontown Coal; elevation, 1240'

			Ft.	In.
1. Shale, grayish-white			2	0
2. Coal	0'	1½"		
3. Slate	0	3½		
4. Coal, medium-hard	1	9	2	2
5. Shale				

The composition of the sample, as reported by Messrs. Hite and Krak, is given under **No. 1** in the table of coal analyses at the end of Chapter X.

THE UNIONTOWN LIMESTONE.

The Uniontown Limestone of Jno. J. Stevenson, a subdivision of the Great Limestone of the First Geological Survey of Pennsylvania, appears to be lacking or very irregular in its occurrence, since it was not observed at several exposures of its horizon, the latter being largely occupied with dark-red shale with limestone nuggets scattered throughout.

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[11] Monongalia-Marion-Taylor Report, W. Va. Geol. Survey, p. 250; 1913.

THE ARNOLDSBURG SANDSTONE.

The Arnoldsburg Sandstone of the writer[12] appears to be generally present wherever its horizon has been preserved from erosion in northwestern Braxton County. It is not quite so massive as at its type locality in Calhoun County, varying from fine- to medium-grained, being more or less flaggy and green to greenish-gray in color, and seldom exceeding 30 feet in thickness. Its dimensions and stratigraphic position are shown in the special sections in Chapter IV for Orlando, Rosedale, and Flatwoods—0.5 Mile Southwest. No quarries were observed on it in either county.

THE LOWER UNIONTOWN COAL.

The Lower Uniontown Coal of White[13], belonging immediately at the base of the stratum last described and 75 to 90 feet below the Uniontown Coal, was not observed at any of the exposures of its horizon visited in either county, although its position is indicated by a spring of water on the northeast hillside at Rosedale, as exhibited in the section for the latter place, published in Chapter IV, pages 76-7.

THE UPPER SEWICKLEY SANDSTONE.

The Upper Sewickley Sandstone of the writer[14], formerly called the Sewickley Sandstone by I. C. White[15], is one of the most persistent beds of the Monongahela Series in either county. It usually outcrops in a great massive cliff, 40 to 60 feet in height, carrying large rounded quartz pebbles, being gray to grayish-brown in color and resembling in both texture and physical appearance the great Waynesburg ledge about 200 feet higher in the measures, a feature that has caused some confusion in correlation work in Braxton and the adjoining Counties of Lewis and Gilmer. Southwestward across the central portions of Salt Lick, Otter, and Birch Districts, it was used as the main "key-rock" in determining the position on Map II of both the Pittsburgh and Upper Kittanning structure contours, its interval above each being shown in the tables in Chapter III, pages 26 and 27-8, respectively.

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[12] Ray V. Hennen, Wirt-Roane-Calhoun Report, W. Va. Geol. Survey, pp. 202-4; 1911.

[13] I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 680; 1908.

[14] Ray V. Hennen, Doddridge-Harrison Report, W. Va. Geol. Survey, p. 199; 1912.

[15] I. C. White, Bull. 65, U. S. Geol. Survey, p. 60; 1891.

Its thickness, character, and stratigraphic position are exhibited in the special sections published in Chapter IV for Berry Siding, Burnsville, Burnsville—1.5 Miles Northwest, Napier, and Orlando, in **Salt Lick District (Braxton)**; for Fairbanks, Gassaway—Northwest Edge, Mark, Sugar Knob, Sutton—1 Mile North, and Sutton—3 Miles North, in **Otter District (Braxton)**; for Dessie, Frametown-Eli Taylor Knob, Rosedale, and Sleith, in **Birch District (Braxton)**; for Flatwoods—0.5 Mile Southwest, in **Holly District (Braxton)**; and for Big Otter—0.5 Mile Southeast, and Nebo—1.5 Miles Southwest, in **Otter District (Clay)**. It is also shown in the log of the L. W. McNair Heirs No. 2 Well (25 on Map II).

In Salt Lick District, it is this ledge that forms the great cliffs high up on the valley walls of Oil Creek between Orlando and Burnsville and not the Waynesburg, as suggested on page 688 of Volume II(A). It is also a prominent cliff-maker near the ridge summits on the waters of Saltlick Creek and the Little Kanawha River below Bulltown.

No quarries were observed on it in either county. Judging from its crop exposures, the ledge appears to be too soft and friable to possess the durable qualities necessary for good building stone. It probably contains too much aluminous matter to be successfully used as concrete aggregate. The regions of its outcrop may be readily determined since it belongs about 130 feet above the Pittsburgh Coal bed the detailed crop of which is shown on Map II.

THE SEWICKLEY COAL.

The Sewickley Coal, belonging immediately at the base of the stratum last described and so named by the First Geological Survey of Pennsylvania, appears to be entirely absent in the territory of this Report, since no coal was observed at the great number of exposures of its horizon visited. This suggestion is further corroborated by Reger[16] in the immediately adjoining portions of Lewis and Gilmer Counties.

THE LOWER SEWICKLEY SANDSTONE.

The Lower Sewickley Sandstone of the writer[17], belonging immediately below the coal last described, is fairly persistent in Braxton and Clay, being green, micaceous, medium-grained, but not nearly so massive and not possessing the same cliff-forming character as the great Upper Sewickley ledge above. Its thickness and stratigraphic position are exhibited in the special sections in Chapter IV for Sutton—3 Miles North in Braxton and for Big Otter—0.5 Mile Southeast in Clay County. In conjunction with the Cedarville and Weston Sandstones below, it generally forms a uniform steep slope around the hillsides between the base of the Sewickley Sandstone cliff and the Pittsburgh Coal bench below. No quarries were observed on it in either county.

THE SEWICKLEY LIMESTONE.

The Sewickley Limestone of Jno. J. Stevenson, at its type locality in southwestern Pennsylvania usually occupying the most of the 60-foot interval separating the Sewickley and Redstone Coal beds, is poorly represented or often absent entirely from the measures of Braxton and Clay. It was observed at only two exposures, the same being shown in the special sections in Chapter IV for Braxton—1 Mile Northwest and Sutton—3 Miles North, where it is only 18 inches and 6 inches in thickness, respectively. It can hardly be considered as an economic asset for sources of either road material or agricultural lime, but it should enrich the soil appreciably in the immediate vicinity of its outcrop.

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[16] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, pp. 121-2; 1916.

[17] Ray V. Hennen, Doddridge-Harrison Report, W. Va. Geol. Survey, p. 201; 1912.

THE CEDARVILLE SANDSTONE.

The Cedarville Sandstone of Reger[18], belonging at its type locality, Cedarville, Gilmer County, just over the Redstone Coal and 41 feet above the Pittsburgh bed, is very persistent in the territory of this Report, generally forming, in conjunction with the Lower Sewickley and Weston ledges, a uniform steep slope around the hillsides wherever the three ledges appear above drainage. It is often massive, medium-grained, micaceous, and greenish-gray in color, with occasional spots of iron peroxide. Since it belongs only 40 to 50 feet above the Pittsburgh Coal, its outcrop follows closely the same regions outlined for the latter on Map II.

Its thickness and stratigraphic position are exhibited in the special sections published in Chapter IV for Burnsville, Dessie—1.1 Miles North, Frametown—Eli Taylor Knob, Rosedale, and Sleith—1.7 Miles Northeast, in Braxton County; and for Pilot Knob, in Clay.

In the western edge of Salt Lick District (Braxton), Gawthrop obtained the following data at a quarry on this ledge:

C. W. Hamric Sandstone Quarry.

On head of Copen Creek, west hillside, 0.2 mile northeast of north portal of Coal and Coke Railway tunnel; **Cedarville Sandstone.**

	Feet.
Shale, grayish-brown, siliceous, visible	5
Sandstone, both massive and flaggy layers, medium-grained, micaceous, medium-hard, gray, (1110' B.), quarry ledge	40
Concealed to Coal and Coke Railway grade	70

According to Gawthrop, considerable stone from this quarry was used as concrete aggregate in lining the Coal and Coke Railway tunnel, 0.2 mile to the southwest, but when visited by him in August, 1915, the railway inspector had condemned this stone and was using rock from a quarry in the East Lynn Sandstone on Sand Run, Upshur County (See Sand Run Section of D. B. Reger in Barbour-Upshur-Western Randolph Report of the State Geological Survey). The Cedarville ledge probably carries too much aluminous material for concrete work, but it should furnish an abundance of stone adapted to the construction of foundations and retaining walls where not exposed to the weather.

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[18] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, p. 124; 1916.

THE REDSTONE COAL.

The Redstone Coal of H. D. Rogers, so designated from a stream of that name in Fayette County, Pennsylvania, and belonging immediately at the base of the sandstone last described and 40 to 50 feet above the Pittsburgh Coal, appears to be entirely absent from the measures in the territory of this Report, since no coal was observed at a large number of exposures of its horizon, the latter usually being indicated by a slight bench in the topography.

THE WESTON SANDSTONE.

The Weston Sandstone of Reger[19], belonging at its type locality in Lewis County in the interval separating the Redstone Coal and Redstone Limestone, is quite persistent in the territory of this Report, where it is massive to flaggy, medium-grained, micaceous, greenish-gray in color, much resembling the Cedarville ledge above and ranging in thickness from 20 to 40 feet. Its character and stratigraphic position are exhibited in the special sections published in Chapter IV for Burnsville, Gassaway—Northwest Edge, Rosedale, Flatwoods—0.5 Mile Southwest, Sutton—3 Miles North, and Sutton, all in Braxton County.

No quarries were observed on this ledge in either county, but it should be adapted to practically the same purposes as suggested above for the Cedarville Sandstone. Its outcrop follows closely the same regions as that outlined for the Pittsburgh Coal on Map II.

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[19] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, p. 124-6; 1916.

THE REDSTONE LIMESTONE.

The Redstone Limestone of Jno. J. Stevenson, designated from its association with the coal of the same name and belonging in the interval separating the latter coal from the Pittsburgh bed below and directly below the stratum last described, is poorly represented in the Monongahela Measures of the territory of this Report, generally being absent entirely. It is noted in the Sutton—3 Miles North Section, page 68.

In the northwestern border of Otter District (Braxton), Gawthrop measured the following section at its exposure in the road along Crooked Fork, just above the mouth of Pistol Run, and 0.7 mile southeast of Progress:

	Ft.	In.
Shale, dark, siliceous, visible	5	0
Limestone, ferriferous, Redstone, (960′ B.)	0	6
Shale	5	0
Concealed to horizon of Pittsburgh Coal	5	0

On the south side of Elk River, in the western edge of Otter District (Braxton), the crop of the Redstone Limestone is exposed almost on the summit of a high knob, 1.3 miles east of Coon Knob, at an elevation of 1715′ L., directly over a prospect in the Pittsburgh Coal bed on the **Houston Davis** farm, as determined by the writer. Here it is gray, hard, cherty, and quite pure, but only a few square rods in extent.

THE WESTON SHALE.

The Weston Shale of Reger[20], occupying at its type locality the interval separating the Redstone Limestone from the Pittsburgh Coal bed, 10 to 15 feet lower in the measures, is generally present in the territory of this Report, but its horizon is often concealed by soil and debris in a marked bench in the topography, the **Upper Pittsburgh Sandstone** of H. D. Rogers, if present, having so coalesced with the overlying Weston ledge, that a distinction could not be made between them.

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[20] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, pp. 128-9; 1916.

THE PITTSBURGH COAL.

The Pittsburgh Coal—the basal member of the Monongahela Series—first designated and described in 1856 by J. P. Lesley from its occurrence at the city of the same name in Pennsylvania, attains minable dimensions in the territory of this Report, being operated successfully at commercial mines along the Coal and Coke Railway on Copen Creek, Braxton County. In the latter region it probably reaches the best development in either county, the following general section being fairly representative:

		Ft.	In.
Draw slate			
Coal, medium-hard, bituminous	2′ 6″ to 3′ 0″		
Bone, sometimes cannelly, or slaty coal	0 2 to 0 4		
Coal, hard, bituminous	2 8 to 3 8	7	0
Slate pavement			

The bone, separating the two benches, appears to represent the "bands" between the "breast" and "bottom" coals of this bed in northern West Virginia and southwestern Pennsylvania, being often pure enough to burn freely and for that reason not always discarded in mining.

The outcrop of the coal is given on Map II where it is known or believed to be of minable thickness. Its approximate elevation above sea-level is also shown on the same map by the green structure contours. In the regions where it has thinned below minable dimensions, the outcrop of its horizon is indicated by the dotted junction line between the Monongahela and Conemaugh Series on Map II.

Its thickness, chemical composition, calorific value and general character at commercial mines, country banks, crop exposures, oil and gas well test borings, and its approximate minable area, as outlined on Figure 4, along with that of the Eagle bed, are described on subsequent pages in Chapter X, in addition to an estimate of its available tonnage.

CHAPTER VI.

STRATIGRAPHY—CONEMAUGH SERIES.

GENERAL DESCRIPTION AND SECTION.

The Conemaugh Series of the Pennsylvanian, originally designated in 1878 by Franklin Platt from its outcrop in Pennsylvania along a river of this name and extending from the base of the Pittsburgh Coal down through the rock column to the top of the Upper Freeport bed, includes a large part of the surface strata in Braxton and Clay Counties, as shown in detail on Map II. The formation, as represented in the State as a whole, has been thoroughly described in a former Report of the Survey[1], its general character in the territory of this Report differing but little from that account in many features. A notable exception is the frequent replacement of the major portion of the Saltsburg and Buffalo Sandstones with red shale in southwestern Braxton and northern Clay, a characteristic that caused the latter to be mistaken for the Pittsburgh Red Shale, and the Upper Freeport Sandstone for the Mahoning ledge in former Reports of the State Survey. This resulted in the wrong assumption of a marked thinning of the underlying Allegheny Series in the immediate locality in question.

The Conemaugh consists of many sandstone beds, alternating with red and sandy shales, nodular and brecciated limestones, and thin coal beds, one of which—Bakerstown—attains minable dimensions and regularity. Two distinct marine fossiliferous horizons were also noted; viz, Ames and Brush Creek Shales. Its limestones are generally more or less impure, their greatest economic worth being the enrichment of the soil in the immediate vicinity of their outcrops. The following general section, compiled from those published on preceding pages in Chapter IV and from numerous special observations, is fairly representative of the Conemaugh rocks in the area:

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[1] I. C. White, Vol. II, W. Va. Geol. Survey, pp. 225-230; 1903.

General Section of the Conemaugh Series in Braxton and Clay Counties.

	Thickness. Feet.	Total. Feet.	
Fire clay and shale, sandy, brown	10 to 30	30	
Sandstone, Lower Pittsburgh, massive, gray, carrying large quartz pebbles and making bold cliffs on waters of Cedar and Steer Creeks	20 to 50	80	80'
Coal, Little Pittsburgh	0 to 2	82	
Shale, variegated, sandy	10 to 18	100	
Sandstone, Connellsville, massive, medium-grained to coarse and pebbly, gray and brown, forms cliffs	30 to 49	149	
Coal, Little Clarksburg	0 to 1	150	70'
Fire clay shale, Clarksburg	0 to 4	154	
Limestone, Clarksburg	0 to 1	155	
Sandstone, Lower Connellsville, massive, often pebbly, gray to brown	25 to 39	194	
Coal, Normantown	0 to 1	195	45'
Shale, red, Clarksburg Reds	20 to 30	225	
Sandstone, Morgantown, massive, coarse, grayish-brown	30 to 40	265	
Shale, sandy	0 to 5	270	
Limestone, Orlando, siliceous, shaly	2 to 3	273	
Coal, Elk Lick	0 to 3	276	81'
Fire clay and shale	0 to 4	280	
Limestone, Elk Lick, impure, shaly, brecciated	0 to 4	284	
Coal, West Milford	0 to 1	285	9'
Shale, Birmingham, sandy, reddish	20 to 29	314	
Sandstone, Grafton, massive, coarse, brown, pebbly	25 to 40	354	
Shale, Ames, dark-green, argillaceous, marine fossils	0 to 5	359	
Coal, Harlem	0 to 1	360	75'
Fire clay shale	0 to 5	365	
Limestone, Ewing, nodular, brecciated, impure	0 to 5	370	
Shale, Pittsburgh Reds, red, with iron ore nuggets	15 to 20	390	
Sandstone, Jane Lew, greenish-gray, lenticular	0 to 10	400	
Shale, Pittsburgh Reds	5 to 15	415	
Sandstone, Saltsburg, massive, gray and brown, often replaced by red shale	20 to 30	445	
Coal, Bakerstown, multiple-bedded	0 to 5	450	90'
Fire clay shale and shale, sandy	0 to 5	455	
Sandstone, Buffalo, massive, gray, often almost entirely replaced with red sandy shale	50 to 59	514	

	Thickness. Feet.	Total. Feet.	
Shale, Brush Creek, with plant and marine fossils	0 to 5	519	
Coal, Brush Creek	0 to 1	520	70
Fire clay shale	0 to 5	525	
Sandstone, Upper Mahoning, massive, coarse, pebbly, grayish-brown, forms cliffs	35 to 43	568	
Limestone, Sutton, yellowish-gray, lenticular	0 to 2	570	
Shale, gray, sometimes carrying the lenticular **Middle Mahoning Sandstone**	0 to 10	580	
Coal, Mahoning, multiple-bedded	0 to 2	582	62'
Fire clay shale, **Thornton**	0 to 5	587	
Sandstone, Lower Mahoning, massive, coarse, pebbly, grayish-brown, forms cliffs	35 to 43	630	
Shale, Uffington, dark-gray, sandy, with plant fossils	0 to 5	635	53'
Coal, Upper Freeport			

The foregoing section of the Conemaugh Series shows a total thickness—635 feet—that is in close harmony with results found in both counties wherever the whole formation was exposed.

DESCRIPTION OF MEMBERS, CONEMAUGH SERIES.

THE LOWER PITTSBURGH SANDSTONE.

The Lower Pittsburgh Sandstone of White[2], in this area separated from the Pittsburgh Coal above by 10 to 30 feet of brown sandy shale and ranging in thickness from 20 to 50 feet, is a very persistent stratum. It is generally massive, coarse, with large rounded quartz pebbles, gray, frequently forming conspicuous cliffs, the latter feature aiding very materially in tracing the overlying Pittsburgh Coal bench over wide regions where the latter coal is either absent or poorly represented.

Its thickness and stratigraphic position are exhibited in the special sections published in Chapter IV for Orlando, Burnsville, and Bulltown, in **Salt Lick District (Braxton)**; German—1 Mile Southeast, Mark, Sutton—1 Mile North, and Sutton—3 Miles North, in **Otter District (Braxton)**; Rosedale, Sleith—1.7 Miles Northeast, Dessie—1.1 Miles North, Servia—1.3 Miles South, and Twistville—Diatter Run, in **Birch District (Braxton)**; Sutton, in **Holly District (Braxton)**; Nebo—

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[2] I. C. White, Vol. II, W. Va. Geol. Survey, p. 244; 1903.

1.5 Miles Southwest and Big Otter—0.5 Mile Southeast, in **Otter District (Clay)**; and Wallback, in **Henry District (Clay)**. Its unusual development has often caused this stratum to be mistaken for the Connellsville ledge, but the presence of the Little Pittsburgh Coal at its base in a prospect opening, 75 feet below another in the Pittsburgh bed, corroborates the correlations in the sections above listed. Its outcrop may be readily determined in the regions of its occurrence, since it should follow closely the same localities as that outlined on Map II for the Pittsburgh Coal horizon.

In the western edge of Salt Lick District (Braxton), this ledge has been quarried at three different points on the waters of Copen Creek, Gawthrop obtaining the following data at one of these, located on the west bank of Copen, 1.3 miles south of Gilmer Station:

		Feet.
Sandstone, flaggy, visible.... 5′ Sandstone, massive, medium-grained, micaceous, gray.15 Elevation, 780′ B.	Lower Pittsburgh......	20

The base of the above quarry belongs about 85 feet below the Pittsburgh Coal bed. Stone from it was used in the construction of bridge abutments in the immediate locality for the Coal and Coke Railway.

Gawthrop obtained the following data at another quarry on this ledge, 0.8 mile due southward, on an east side branch of Copen Creek, the stone from it being used for the same purposes as that last described:

	Feet.
Sandstone, massive, medium-grained, pebbly, somewhat broken, micaceous, Lower Pittsburgh (850′ B.).......	20

Here, the base of the ledge comes 80 feet below the Pittsburgh Coal.

Two miles southward in the same District, Gawthrop obtained the following data at a quarry on this ledge on the west side of Copen and the Coal and Coke Railway, the stone from it being used in the construction of the latter line:

W. T. Davis Quarry.

			Feet.
Concealed from opening in Pittsburgh Coal			10
Sandstone, shaly	10'	Lower Pittsburgh. (900' B.)	60
Sandstone, massive	10		
Shale, greenish-gray, to railroad	2		
Concealed	23		
Sandstone, massive, gray, visible	15		
Concealed to bed of Copen Creek			10

In the eastern portion of Otter District (Braxton), the Lower Pittsburgh Sandstone has been quarried at three different points, the following data being obtained by Gawthrop at one of these, located on a point along the north hillside of Cedar Creek, opposite the mouth of Perkins Fork:

			Feet.
Sandstone, flaggy	10'	Lower Pittsburgh. (985' B.)	35
Sandstone, massive, gray, coarse, pebbly, micaceous	15		
Concealed to base of quarry	10		

Here, the base of the quarry comes 85 to 90 feet below the Pittsburgh Coal, the stone from it being used for the construction of bridge abutments for the Coal and Coke Railway in the immediate locality.

On the north hillside, one-third mile up Shaver Fork of Perkins Fork, Gawthrop measured the following section at a quarry on this ledge:

J. T. Lockard Quarry.

			Feet.
Sandstone, massive, coarse grained, grayish brown	20 '	Lower Pittsburgh. (970' B.)	40.5
Shale	0.5		
Sandstone, massive and flaggy, medium-grained	20		

Three and a half miles southwestward in Otter District, Gawthrop obtained the following data at a quarry in the Lower Pittsburgh ledge:

Chapel Church Quarry.

Located on north hillside of Left Fork of Steer Creek, immediately northeast of the mouth of Straight Fork; **Lower Pittsburgh Sandstone**; elevation, 1070′ B.

	Feet.
Sandstone, massive, coarse, pebbly, medium-soft, grayish-brown, forming cliff	20

Here, the base of the quarry comes 75 feet below the horizon of the Pittsburgh Coal. The stone was used in the construction of the foundation for Chapel Church in the immediate vicinity.

Westward on the waters of O'Brien Fork and Right Fork of Steer Creek, the Lower Pittsburgh Sandstone is very persistent and is a prominent cliff-maker, thus making easily available an almost inexhaustible supply of stone for building purposes. Its more or less siliceous and conglomeratic character is in its favor for use as concrete aggregate in the construction of local highway bridges over the small streams in the immediate region of its outcrop.

THE LITTLE PITTSBURGH COAL.

The Little Pittsburgh Coal of White[3], named from its association with the thicker bed above and belonging in the territory of this Report at the base of the stratum last described, 70 to 90 feet below the top of the Conemaugh Series, is very irregular and poorly represented, being absent entirely at many exposures of its horizon. In the northeastern corner of Salt Lick District (Braxton), Gawthrop obtained the following data at a digging in this bed:

Thos. Conley Coal Prospect—No. 2 on Map II.

Salt Lick District, on west bank of Posey Run, 1.7 miles northwest of Orlando; **Little Pittsburgh Coal**; elevation, 950′ B.

	Ft.	In.
Sandstone, shaly, visible	5	0
Coal, thickness concealed, reported	1	6

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[3] I. C. White, Vol. II, W. Va. Geol. Survey, p. 245; 1903.

The above opening is 60 feet below the horizon of the Pittsburgh Coal.

In the northwestern border of the same District, at **Coal Exposure—No. 3 on Map II,** located on the west bank of Copen Creek, slightly over a mile northeast of the mouth of Bull Fork, Gawthrop reports a trace of Little Pittsburgh Coal near the base of the Lower Pittsburgh Sandstone, at an elevation of 830′ B., 80 to 90 feet below the Pittsburgh bed.

Due southward in the same District, Gawthrop obtained the following data for this seam:

Coal Exposure—No. 4 on Map II.

Salt Lick District, on north hillside of Copen Creek, 1 mile southeast of the mouth of Bull Fork; Little Pittsburgh Coal; elevation, 900′ B.

	Ft.	In.
Sandstone, massive, medium-grained, pebbly, micaceous, visible	15	0
Coal, slaty	0	3
Fire clay shale		

Four miles southeastward in the same District, at **Coal Opening—No. 5 on Map II,** located on Burns Run, 1.6 miles northeast of the mouth of Scott Fork of Cedar Creek, the Little Pittsburgh Coal is about 2 feet in thickness, according to information given Gawthrop by S. S. Posey, coming at an elevation of 1045′ B., 75 feet below the horizon of the Pittsburgh bed.

Two and a half miles southwestward in Otter District (Braxton), Gawthrop obtained the following data at a digging in what appears to be this coal:

Susan F. Westfall Coal Prospect—No. 6 on Map II.

On east hillside, 1 mile up Westfall Fork of Cedar Creek; Little Pittsburgh Coal; elevation, 1110′ B.

	Feet.
Sandstone, massive, broken, Lower Pittsburgh, visible	5
Shale, dark	1
Coal, thickness concealed, reported	1

Interval below the horizon of the Pittsburgh bed, about 60 feet.

At the **L. F. Barr Coal Prospect—No. 7 on Map II,** in the southwestern edge of Birch District (Braxton), on the east side of the road on Left Fork, 0.4 mile north of Elmira, the **Little Pittsburgh Coal** was once opened by F. M. Gibson at the base of the massive, pebbly Lower Pittsburgh Sandstone, at an elevation of 1080′ B., 75 feet below another opening in the Pittsburgh Coal, as determined by the writer. L. F. Barr reports the former about 3 feet in thickness, the coal itself being concealed by debris when visited during 1915.

A careful study of all the information collected concerning the Little Pittsburgh Coal in the territory of this Report warrants its classification as an unminable bed.

THE CONNELLSVILLE SANDSTONE.

The Connellsville Sandstone of Jno. J. Stevenson, originally described from its outcrop at Connellsville, Pennsylvania, and belonging 90 to 110 feet below the Pittsburgh Coal, is very persistent in Braxton and Clay Counties, ranging in thickness from 20 to 40 feet. It is generally massive, medium-grained to coarse-, often pebbly, micaceous, and gray to grayish-brown in color, sometimes mottled with iron peroxide, and forms steep slopes and frequent cliffs around the hillsides along its outcrop. Its thickness and stratigraphic position are exhibited in the special sections published in Chapter IV for Burnsville, Bulltown, Braxton—1 Mile Northwest, Lloydsville, German, Rosedale, Sleith, Twistville-Diatter Run, High Knob, and Sutton in Braxton County; for Big Otter, Wallback, and Pilot Knob in Clay; and in the logs of oil and gas test borings Nos. 69 and 93 on Map II, the details of which are given on subsequent pages in Chapter IX.

In the northwestern border of Salt Lick District (Braxton), Gawthrop reports a **quarry in the Connellsville Sandstone,** 0.5 mile up Hyers Run, on north hillside, 2 miles west of Burnsville, the top of which comes at an elevation of 810′ B., 140 feet below the Pittsburgh Coal. Only 10 feet of the upper portion of the ledge was visible, this part being massive, medium-grained, micaceous, and gray in color, the stone from it being used in the abutments for the Coal and Coke Railway bridge over Hyers Run.

In Otter District (Braxton), Gawthrop obtained the following data:

Quarry in Connellsville Sandstone.

On north hillside of Perkins Fork, 0.4 mile southeast of Riffle; elevation, 995' B.

		Feet.
Shale, grayish-brown, visible		8
Sandstone, shaly	5'	
Sandstone, massive, medium-coarse, few pebbles, micaceous, greenish-gray	12	17

The base of the above quarry comes 130 feet below the horizon of the Pittsburgh Coal. The stone was used in the construction of a double-arch culvert over Perkins Fork at Riffle.

In other portions of the State, the Connellsville Sandstone enjoys a fine reputation for building stone. In the territory of this Report, it appears to be in normal development both in physical appearance and texture, and, owing to its accessibility in northwestern Braxton County and the northern point of Clay, it should furnish an abundance of cheap stone adapted to general building purposes.

THE LITTLE CLARKSBURG COAL.

The Little Clarksburg Coal of White[4], belonging just at the base of the stratum last described and 140 to 160 feet below the Pittsburgh bed, is of scanty occurrence in the two counties, being generally too thin, irregular, and impure to have any economic value. Its stratigraphic position is exhibited in the log of the William T. Brosius No. 1 Well—No. 34 on Map II, in the western edge of Salt Lick District (Braxton), 0.1 mile northwest of Copen.

The following data were obtained by the writer at the only digging observed on this bed in either county:

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[4] I. C. White, Bulletin 65, U. S. Geol. Survey, p. 88; 1891.

C. S. Hall Coal Prospect—No. 8 on Map II.

Otter District (Clay), south hillside of Boggs Fork, ¾ mile northeast of mouth of Katy Run; Little Clarksburg Coal; elevation, 1050' B.

	Ft.	In.
Coal, slaty	1	8

At **Coal Exposure—No. 9 on Map II,** along the hill road, 0.4 mile northwestward from the opening last described, the writer measured the following section:

	Ft.	In.
Sandstone, large quartz pebbles, Lower Pittsburgh	45	0
Concealed	35	0
Coal, visible, Little Clarksburg	1	3

The above coal comes at an elevation of 1020' B., about 160 feet below the horizon of the Pittsburgh bed.

THE CLARKSBURG FIRE CLAY SHALE.

The Clarksburg Fire Clay Shale of the writer[5], belonging immediately at the base of the coal last described, is generally thin and unimportant, usually being scanty and too siliceous to have any economic value.

THE CLARKSBURG LIMESTONE.

The Clarksburg Limestone of White[6], belonging at its type locality—Clarksburg, West Virginia—from a few inches to 20 feet below the Little Clarksburg Coal and ranging in thickness from 10 to 30 feet, is of scanty occurrence in the territory of this Report. The following section, measured with aneroid by Gawthrop at the only exposure of this ledge observed, was obtained on the north hillside of Brushy Fork of Rush, 1.8 miles northwest of Gassaway:

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[5] Ray V. Hennen, Doddridge-Harrison Report, W. Va. Geol. Survey, p. 236; 1912.

[6] I. C. White, Bulletin 65, U. S. Geol. Survey, p. 88; 1891.

Brushy Fork Section.

	Thickness. Feet.	Total. Feet.	
Concealed from Pittsburgh Coal horizon....	49	49	
Sandstone, massive, gray and brown, pebbly, Lower Pittsburgh....................	25	74	74′
Concealed..................................	60	134	
Shale, red.................................	5	139	
Sandstone, massive, greenish-gray, Connellsville..................................	10	149	
Concealed..................................	10	159	
Shale, red.................................	4	163	
Limestone, nodular, hard, gray, lenticular, Clarksburg, (1075′ B.), 12″ to...........	2	165	91′
Concealed, with sandstone.................	5	170	
Shale, red, Clarksburg......................	25	195	
Sandstone, massive, Lower Connellsville...	10	205	
Concealed, with red shale..................	40	245	
Sandstone, massive, fine-grained, greenish-gray, Morgantown......................	25	270	105′

THE LOWER CONNELLSVILLE SANDSTONE.

The Lower Connellsville Sandstone of the writer[7], named from its association below the Connellsville ledge at its type locality—Morgantown, West Virginia—where its base comes 190 to 200 feet below the Pittsburgh Coal bed, is a very persistent stratum in the territory of this Report. It is generally massive, medium- to coarse-grained, often pebbly, micaceous, and gray to grayish-brown in color, sometimes mottled with spots of iron peroxide, although not to the same degree as at Morgantown, nor so quartzitic in texture as at the latter place. The investigations of the writer in Braxton and Clay Counties and D. B. Reger in Barbour and Upshur, during 1915, show that the position of this ledge is below and not above the Clarksburg Limestone as originally described, and that the stratum immediately at its base in the Mona Section, as published on page 270 of the Monongalia-Marion-Taylor Report, is not the Clarksburg Limestone, but represents an unclassified ledge which could be appropriately referred to as the **Mona Limestone.** Referring to the Morgantown Section, page 115 of the Report last mentioned, both the Little Clarksburg

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[7] Ray V. Hennen, Monongalia-Marion-Taylor Report, W. Va. Geol. Survey, pp. 115, 270 and 277; 1913.

Coal and the Clarksburg Limestone evidently belong in the 19 feet of concealed interval 230 feet from the top of the section.

The thickness and stratigraphic position of this sandstone are exhibited in the special sections given in Chapter IV for Orlando, Burnsville, Sutton—1 Mile Northwest, Frametown—Eli Taylor Knob, Strange Creek, and High Knob, in Braxton County; Wallback and Pilot Knob, in Clay; and in the logs of oil and gas test borings Nos. 93 and 95 on Map II. No quarries were observed on it in either county, but its wide distribution at outcrop in northwestern Braxton and northern Clay should make an abundant supply of durable stone easily available for local use in the construction of foundations and highway bridges.

THE NORMANTOWN COAL.

The Normantown Coal of Reger[8], belonging immediately at the base of the sandstone last described and 185 to 200 feet below the Pittsburgh bed, was observed at only one point in the territory of this Report; viz, at **Coal Exposure—No. 10 on Map II,** located on the north hillside of Oil Creek, 0.3 mile northwest of the railway station at Orlando, its thickness and stratigraphic position here being shown in the special section in Chapter IV for the latter point, pages 44-5. It is too thin and irregular to be of any economic importance.

THE CLARKSBURG RED SHALE.

The Clarksburg Red Shale of the writer[9], belonging at its type locality—Clarksburg, West Virginia—in the interval separating the Clarksburg Limestone from the Morgantown Sandstone, is fairly persistent in Braxton and Clay Counties, the upper portion of it being largely replaced by the Lower Connellsville Sandstone. Its thickness and stratigraphic position are exhibited in the section published in Chapter IV for Sleith—1.7 Miles Northeast; and for Brushy Fork, under the

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[8] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, pp. 143-4; 1916.

[9] Ray V. Hennen, Doddridge-Harrison Report, W. Va. Geol. Survey, p. 240; 1912.

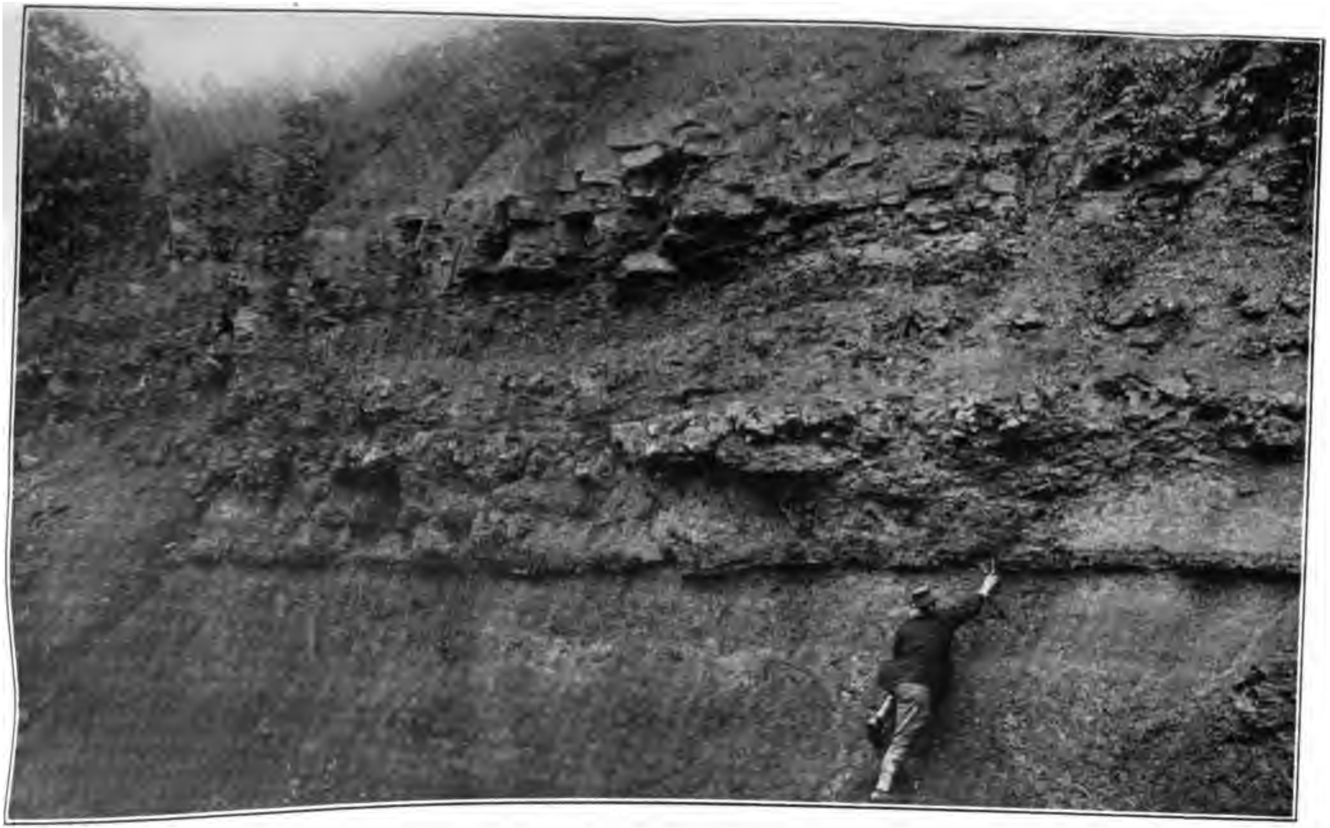

PLATE VIII.—Showing outcrop of Orlando Limestone and Elk Lick Coal in Coal & Coke Railway cut one-half mile west of Orlando. The 6-inch rule is held on the coal.

description of the Clarksburg Limestone. For the chemical composition of this shale in the immediately adjoining region of Lewis and Gilmer, the reader is referred to pages 144-5 of the Report for the latter Counties. Judging from these results and its wide distribution in northwestern Braxton and northern Clay, it should prove useful for the manufacture of both building and paving brick.

THE MORGANTOWN SANDSTONE.

The Morgantown Sandstone of Jno. J. Stevenson, named from its outcrop at Morgantown, West Virginia, and belonging 220 to 240 feet below the Pittsburgh Coal bed, is very persistent in Braxton and Clay Counties where it forms steep slopes and frequent cliffs along its outcrop, and ranges in thickness from 15 to 40 feet. It is generally massive, medium-grained, micaceous, greenish-gray in color, carrying more or less feldspathic material and some lime, a feature that does not specially recommend its use as a building stone where durable qualities are desired in exposed surfaces.

Its thickness and stratigraphic position are exhibited in the special sections published in Chapter IV for Orlando, Burnsville, Burnsville—1.2 Miles East, Napier—1.6 Miles North, Gassaway—2 Miles West, Gassaway—2¼ Miles South, Sutton—Southwest Edge, Sleith—1.7 Miles Northeast, and Sutton, in Braxton County; for Wallback and Pilot Knob, in Clay; Brushy Fork, above, under the description of the Clarksburg Limestone; and in the logs of oil and gas test borings Nos. 95 and 101 on Map II.

Gassaway Sandstone Quarry.—On the north hillside of Elk River at Gassaway, due north of the mouth of Little Otter Creek, it is this stratum that was quarried to furnish stone for the public highway bridge over the former stream, according to Gawthrop, who measured the following section at the ledge exposure:

	Thickness. Feet.	Total. Feet.	
Interval from Pittsburgh Coal horizon......	230	230	
Sandstone, Morgantown, massive, medium-grained, micaceous, gray and brown, quarry ledge, (1045' B.)................	40	270	270'
Shale, gray..................................	5	275	

	Thickness. Feet.	Total. Feet.	
Concealed	50	325	
Sandstone	5	330	
Concealed	5	335	
Shale, red	5	340	
Limestone, **Ewing**, gray, nodular	0.5	340.5	70.5′
Shale and concealed	10	350.5	
Sandstone, shaly, forming cliff, **Jane Lew**	20	370.5	
Sandstone, massive, medium-coarse, hard, **Saltsburg**	25	395.5	
Concealed	14.5	410	
Sandstone, shaly	10	420	
Concealed to horizon of **Brush Creek Coal**, exposed ¼ mile southwest	85	505	164.5′

The foregoing section was measured with aneroid southward on a slight rise in the strata, so that the results are slightly less than they should be.

Jno. B. Hoover Sandstone Quarry.—Slightly over 4 miles southeastward in Otter District (Braxton), 2 miles eastward from the summit of Coon Knob and on the north side of the public road, it is this ledge that was quarried on the land of John B. Hoover to furnish stone for the construction of his milk-house, at an elevation of 1360′ B., the base of the quarry belonging about 15 feet above the bottom of the ledge and 265 feet below the horizon of the Pittsburgh Coal bed, as determined by the writer. Here it is massive, very coarse, soft, yellowish-brown in color, only 6 feet of the sandstone being worked. The quarry-face was 20 to 30 feet long and worked back 10 feet into the hill. Its general texture and physical appearance at this exposure do not recommend it for use for exposed surfaces.

THE ORLANDO LIMESTONE.

The Orlando Limestone of Reger[10], belonging at its type locality—Orlando, Lewis County—in the 5 to 15 feet of interval separating the stratum last described from the underlying Elk Lick bed, is very persistent in Salt Lick District, Braxton County, its outcrop being noted at several exposures along Oil Creek and the Little Kanawha River above Burnsville, where it is usually shaly, nodular, and lenticular, carrying a few fresh-water fossil forms. In this region its thickness and stratigraphic position are exhibited in the special sections published in Chapter IV for Orlando, Burnsville, Burnsville—1.2 Miles East, and Napier—1.6 Miles North.

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[10] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, pp. 147-8; 1916.

It is this ledge that is exposed in the Coal and Coke Railway cut along Oil Creek, 0.5 mile northeast of the mouth of McCauley Run, where the following section was obtained by the writer:

			Ft.	In.
Shale, greenish-red, sandy, visible			15	0
Sandstone, flaggy			2	0
Shale, green			1	0
Limestone, dark-gray, hard	1' 0"	Orlando. (780' B.)	3	9
Shale, limy	0 6			
Shale, black	0 3			
Limestone, shaly, nodular, brecciated	2 0			
Shale, yellowish-gray			4	0

Slightly over a mile farther up Oil Creek, the writer measured the following section at an exposure of the Orlando Limestone in a cut in the same railroad, opposite the mouth of Road Run:

	Ft.	In.
Sandstone, shaly, Morgantown, visible	20	0
Shales, sandy	7	0
Limestone, nodular, Orlando, (810' B.)	2	0
Coal, slaty, Elk Lick	0	3
Limestone, nodular, Elk Lick, 12" to	3	0
Shales, red, sandy, Birmingham, to railroad grade	25	0

On the north hillside of the Little Kanawha River, ¼ mile northwest of the mouth of Riffle Run, slightly over 2 miles southeast of Burnsville, the writer measured the following section at an exposure of this ledge:

			Ft.	In.
Shales, sandy, and red, with sandstone			15	0
Limestone	0' 10"	Orlando Limestone. (815' B.)	4	4
Shale	1 0			
Slate, black	0 2			
Shale	0 10			
Limestone	1 6			
Shale, red				

Away from this portion of Salt Lick District, the Orlando Limestone was not observed. It appears to be too irregular and impure to ever be quarried successfully for agricultural lime or road material, its chief economic importance being the enrichment of the soil in the immediate region of its outcrop.

THE ELK LICK COAL.

The Elk Lick Coal of the First Geological Survey of Pennsylvania, belonging from a few inches to 20 feet below the Morgantown Sandstone, directly below the Orlando Limestone and 260 to 280 feet below the Pittsburgh Coal bed, is of very irregular occurrence in the territory of this Report, at one or two prospects attaining minable dimensions, but its slaty partings and very lenticular nature immediately at the latter diggings warrant its classification as an unmerchantable seam. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Orlando, Gassaway—2 Miles West, Flatwoods—0.5 Mile Southwest, and Sutton. It is also reported in the log of the **Philip A. Gibson water well—No. 28 on Map II**—located 1.4 miles N. 80° E. of Coon Knob and 4 miles southeast of Gassaway, the latter penetrating to a depth of 106 feet.

At **Coal Exposure—No. 11 on Map II,** located in the northeastern corner of Salt Lick District (Braxton), ¼ mile northwest of Orlando, it is only 6 inches in thickness as shown by the Orlando Section.

In the same District, Gawthrop obtained the following data at an exposure of this coal:

Coal Exposure—No. 12 on Map II.

On west bank of Threelick Run, 0.3 mile northwest of mouth of Grasslick and slightly over a mile north of Orlando; **Elk Lick Coal;** elevation, 800′ B.

	Ft.	In.
Limestone, visible........1′ 0″ Shale and concealed......5 0 Limestone, hard and gray.2 0 } **Orlando Limestone.**	8	0
Shale, greenish....................................	2	0
Coal, slaty, Elk Lick (800′ B.)......................	0	6
Concealed to bed of Threelick Run..................	1	0

At **Coal Exposure No. 13 on Map II,** in the hill road in the northwestern corner of Holly District (Braxton), it is only 3 to 4 inches thick, as shown in the section given in Chapter IV for Flatwoods—0.5 Mile Southwest, page 92.

At **Coal Exposure No. 14 on Map II,** one-third mile southwestward in the same District, about the same thickness is visible at an elevation of 1215′ B., 10 to 15 feet above 6 to 8 inches of Elk Lick Limestone.

In Otter District (Braxton), Gawthrop obtained the following data:

C. C. Crockett Coal Prospect—No. 15 on Map II.

On west hillside of Walnut Fork of Little Otter Creek, 1.8 miles north of railway bridge at Gassaway; **Elk Lick Coal**; elevation, 925′ B.

	Feet.
Sandstone, massive, greenish-gray	8
Shale	8
Concealed	28
Shale, greenish-red	15
Coal, thickness concealed, reported	3
Concealed	10
Sandstone, visible	5

At the above prospect a boring is reported to have started in the same hill, just back of this opening, and found only a few inches of Elk Lick Coal, a feature that is in harmony with the occurrence of this bed in the territory of this Report.

At **Coal Prospect No. 16 on Map II,** located on the west hillside of Sugarcamp Run, 1.4 miles south of Clickton, Gawthrop reports the Elk Lick Coal 15 inches in thickness, as shown in the section for Gassaway—2 Miles West, page 65.

THE ELK LICK LIMESTONE.

The Elk Lick Limestone of Messrs. Pratt[11], belonging from a few inches to 20 feet below the coal last described, is poorly represented in Braxton and Clay, being siliceous, nodular, brecciated, and lenticular, and ranging in thickness from 0 to 5 feet. Its stratigraphic position is exhibited in the special sections given in Chapter IV for Bulltown, Gassaway—2 Miles West, Gassaway—2¼ Miles South, Sutton—1 Mile North, Sutton—Southeast Edge, and Sutton, all in Braxton County. Since it belongs only 160 to 175 feet above the Bakerstown Coal, its outcrop is confined to practically the same regions as that outlined for the latter seam on Map II.

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[11] Report HHH, Second Geol. Survey of Penna.

In Salt Lick District (Braxton), Gawthrop reports this ledge gray, hard, and nodular, 1 to 2 feet in thickness, at an elevation of 1350′ B., in an outcrop exposure along the ridge road, 1.4 miles east of Bulltown.

In the extreme eastern edge of the same District, he reports it 1 foot in thickness at an elevation of 1365′ B., in an exposure along the hill road on the head of Knawl Creek, slightly over a mile west of Ireland, 70 feet above the Harlem Coal and 170 feet above the Bakerstown seam.

In the western portion of Otter District (Braxton), Gawthrop reports this limestone 2 feet in thickness, at an elevation of 945′ L., in a crop exposure on Limestone Run, 0.7 mile east of Belfont, as shown in the section given below under the description of the West Milford Coal.

Four-tenths mile eastward in the same District, Gawthrop obtained the following section at the crop of this ledge in the public road:

	Feet.
Interval from Pittsburgh Coal	290
Shale, red, visible	5
Limestone, gray, Elk Lick (1000′ B.)	1
Shale, gray, siliceous	2
Sandstone, shaly, Grafton	5

In the northwestern corner of Holly District (Braxton), this limestone is only 6 to 8 inches in thickness, bluish-gray and hard, 15 feet below the crop of the Elk Lick Coal at Coal Exposure No. 14 on Map II, 1 mile southwest of Flatwoods Station.

In the extreme western edge of Holly District, Gawthrop measured the following section at its exposure in the ridge road on the Otter-Holly District Line, 1.8 miles due north of Tesla:

	Feet.
Fire clay shale, visible	2
Shale, gray, and concealed	8
Shale, red	15
Limestone, Elk Lick, (1435′ B.)	1
Shale, greenish-gray, visible	5

Eight-tenths mile due southward in the same ridge road, Gawthrop reports this limestone one foot thick, at an elevation of 1510′ B., 460 feet above the horizon of the Upper Kittanning

Coal as exhibited by the structure contours on Map II.

No exposures of the Elk Lick Limestone were observed in Clay County, and in Braxton, it appears to be too thin, impure, and irregular to be successfully operated as a source of agricultural lime or road material, but its decomposition adds greatly to the fertility of the soil in the immediate region of its outcrop.

THE WEST MILFORD COAL.

The West Milford Coal of the writer[12], belonging at its type locality—West Milford, Harrison County, West Virginia—immediately below the limestone last described, seldom occurs in the territory of this Report, the only coal observed at this horizon being the following exposure in the western portion of Otter District (Braxton), examined by Gawthrop:

Coal Exposure—No. 18 on Map II.

In bed of Limestone Run, 0.7 mile east of Belfont; **West Milford Coal**; elevation, 935' B.

	Feet.
Interval from **Pittsburgh Coal**	255
Sandstone, flaggy, visible	10
Concealed, with shale	10
Slate, bituminous, blocky	1.5
Sandstone	2
Limestone, gray and hard, **Elk Lick**, (945' L.)	2
Shale, dark	2
Concealed	5
Coal, in Limestone Run	1.5

It is very evident that this bed is too thin and irregular to have any economic importance.

THE BIRMINGHAM SHALE.

The Birmingham Shale of Stevenson[13], belonging at its type locality—Birmingham, Pennsylvania—in the interval separating the Elk Lick and Ames Limestones and consisting of red and variegated sandy shales, is present in the territory of this Report, but its lower portion is often largely replaced by the Grafton Sandstone, the remainder seldom exceeding 20 feet in thickness. Its stratigraphic position is exhibited in the Orlando Section, pages 44-5.

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[12] Ray V. Hennen, Doddridge-Harrison Report, W. Va. Geol. Survey, pp. 245-8; 1912.

[13] Jno. J. Stevenson, Report K, Sec. Geol. Survey of Pa., pp. 79 and 309-310.

THE GRAFTON SANDSTONE.

The Grafton Sandstone of White[14], belonging at its type locality—Grafton, West Virginia—5 to 25 feet below the Elk Lick Limestone and 15 to 20 feet above the Harlem Coal, is very persistent in both Braxton and Clay Counties, where it is usually massive, medium-grained to coarse-, gray to grayish-brown in color, often carrying quartz pebbles and sometimes being broken and shaly. It ranges in thickness from 20 to 50 feet, and forms steep slopes and frequent cliffs along its outcrop, the latter being confined to practically the same region as that outlined on Map II for the horizon of the Bakerstown Coal, since it belongs only slightly over 100 feet above the latter seam. Its thickness and stratigraphic position are exhibited in the special sections published in Chapter IV for Burnsville, Burnsville—1.2 Miles East, Bulltown, Sugar Knob, Gassaway—2¼ Miles South, Sutton—1 Mile Northwest, Sutton—½ Mile Northwest, Rosedale, Servia—1.3 Miles South, Twistville—Diatter Run, Herold, Strange Creek, and Flatwoods—0.5 Mile Southwest, in Braxton County; Big Otter—0.5 Mile Southeast, Wallback, and Pilot Knob, in Clay; in the logs of oil and gas well borings Nos. 91, 93, 94, and 95 on Map II, about two miles southwest of Rosedale; and in the log of the Chas. Singleton Coal Test Boring—No. 5 on Map II, on the head of Burns Run, 1.6 miles northwest of Rollyson.

At several of the above localities, this ledge should furnish a fair quality of building stone for general purposes. It is not only easily worked, but its grayish-brown texture offers an attractive appearance, making it suitable for architectural uses.

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[14] I. C. White, Vol. II, W. Va. Geol. Survey. p. 255; 1903.

AMES LIMESTONE AND SHALE.

The **Ames Limestone**, originally named and described by Andrews of the Ohio Geological Survey, and later subdivided by the writer[15] into the **Upper Ames Limestone, Ames Shale, and Lower Ames Limestone**, all of which carry marine fossil shells in Harrison County, is represented by a marine fossiliferous shale, limestone being observed at only two exposures.

In Salt Lick District, the shale is 4 feet in thickness, carrying marine fossils in abundance, at an exposure on the north edge of the public road on the Little Kanawha River, 1.2 miles east of Burnsville, its stratigraphic position being shown in the section for this point published in Chapter IV, page 46.

On the south side of the same river, 4¼ miles southeastward in Salt Lick District, the writer observed 1 foot of marine fossiliferous shale at this horizon on the south side of the road, 0.6 mile southeast of the mouth of Big Run, at an elevation of 795′ B., 320 feet below the horizon of the Pittsburgh Coal bed and 3 feet below an exposure of the Grafton Sandstone.

The shale is dark-green and 5 feet in thickness, carrying minute marine fossil shells, at an elevation of 910′ B., in a crop exposure along the hill road on the east side of Big Run, 0.4 mile southeast of Napier.

In the same District (Salt Lick), Gawthrop measured the following section at an exposure of this horizon on Knawl Creek, on the northwest side of the public road, 0.6 mile northeast of the mouth of Little Knawl:

	Feet.
Interval from Pittsburgh Coal	300
Sandstone, massive, medium-grained, greenish-gray, Grafton, visible	10
Shale, gray, siliceous	10
Limestone, gray and hard, nodular, Ames, (780′ B.)	0.5
Concealed, with shale	

In the northeastern edge of the same District, Gawthrop measured the following section at the outcrop of the shale along the hill road on the head of Barbecue Run of Knawl Creek:

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[15] Ray V. Hennen, Doddridge-Harrison Report, W. Va. Geol. Survey, p. 250; 1912.

	Feet.
Sandstone, massive, Grafton, visible	10
Shale, gray, siliceous, partly concealed	9
Shale, argillaceous, greenish-gray, with marine fossils, Ames, (1115′ B.)	1
Coal, Harlem	0.5
Shale	

In the northern portion of Holly District (Braxton), the writer measured the following section at the outcrop of the Ames Shale in the public road just on the west side of the low gap over the Baltimore and Ohio Railroad tunnel, 2 miles southeast of Flatwoods:

	Feet.
Sandstone, massive, coarse, brown, Grafton	25
Shale, dark-green, argillaceous, with very small marine fossil shells, Ames, (1197′ L.)	2
Shale, red, to road at low gap	15
Concealed	60
Coal, Bakerstown, at digging northeast of tunnel, closed, estimated	2

Southwestward from the foregoing localities, no marine fossils were observed at this horizon, with the possible exception of its exposure along the east bank of Rush Fork of Little Otter Creek, 1 mile southeast of the summit of Sugar Knob, as exhibited in the section given in Chapter IV for the latter point, page 64. Here it is almost typical in texture and physical appearance with its occurrence in Monongalia and Preston Counties, but the fossil shells are very minute and indistinct.

THE HARLEM COAL.

The Harlem Coal of Newberry[16], belonging just under the Ames Limestone and Shale, and 325 to 350 feet below the Pittsburgh Coal bed, is thin, irregular, and of doubtful value in the territory of this Report, although attaining locally, on the waters of Saltlick Creek in Braxton County, minable dimensions. Its thickness and stratigraphic position are exhibited in the special sections published in Chapter IV for

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[16] J. S. Newberry, Bull. Geol. Soc. of America, Vol. 17, p. 156; 1906.

Burnsville—1.2 Miles East, Bulltown, Sutton—½ Mile Northwest, Sutton—1 Mile Northwest, and Twistville—Diatter Run, all in Braxton.

All the exposures observed of this coal are confined to the latter County, the major number of which occur in Salt Lick District. At the **W. A. Nicholson Heirs Coal Stripping—No. 19 on Map II**—located in the edge of a run on the south side of the Little Kanawha River, 0.8 mile west of the mouth of Riffle Run, at an elevation of 755′ B., this bed is 18 inches in thickness, according to information furnished Gawthrop, its interval here below the Pittsburgh Coal being about 320 feet. The seam was concealed by debris when visited by the latter during 1915.

In the same District (Salt Lick), at **Coal Exposure—No. 20 on Map II,** along the hill road on the east side of Big Run, 1 mile westward from Bulltown, the Harlem Coal is represented by 4 to 6 inches of coaly shale, at an elevation of 910′ B., directly below the fossiliferous Ames Shale. It is only 6 inches in thickness at **Coal Exposure No. 21 on Map II,** located along the hill road on the head of Barbecue Run of Knawl Creek in the northeast edge of the same District, as shown in the local section given on a preceding page of this Chapter under the description of the Ames Limestone and Shale.

At **Coal Exposure No. 22 on Map II,** located 0.6 mile southeastward along the hill road on a branch of Left Fork, it is 1 foot in thickness, at an elevation of 1170′ B., 120 feet above the crop of the Bakerstown Coal in the same road, according to Gawthrop. The following prospect in the same bed was examined by Gawthrop:

Coal Prospect—No. 23 on Map II.

Edge of Lewis County, north edge of hill road on head of Big Run, ¾ mile west of Ireland; Harlem Coal; elevation, 1255′ B.

	Feet.
Sandstone, massive, Grafton, visible	7
Shale, dark, Ames	2
Coal, thickness concealed, not much found	..
Interval to Bakerstown Coal	80

In the southwest portion of Salt Lick District, the two following openings were examined by the writer:

Wm. N. Singleton Farm Mine—No. 24 on Map II.

On north bank, ¾ mile up Buffington Run of Saltlick Creek; **Harlem Coal**; elevation, 855' B.

			Ft.	In.
Coal	0'	9"		
Shale, hard	2	6		
Coal	0	9	4	0

The above digging had fallen shut when visited in 1915, the bed-section being furnished by a native.

Wm. N. Singleton Farm Mine—No. 25 on Map II.

On north bank of same stream, ⅛ mile southwest of Mine 24; **Harlem Coal**; elevation, 855' B.

			Ft.	In.
Shale, dark-gray, no fossils seen, **Ames**			5	0
Slate, black			1	0
Coal	0'	7"		
Shale, dark-gray	0	5		
Coal	0	11	1	11
Shale and concealed				

The coal at both the foregoing country banks, as also at the following examined by both Gawthrop and the writer, comes about 330 feet below the horizon of the Pittsburgh Coal bed:

W. H. Coger Coal Prospect—No. 26 on Map II.

Due south of mouth of Cloat Run, 0.6 mile northwest of Rollyson; **Harlem Coal**; elevation, 850' B.

	Feet.
Sandstone, **Grafton**, visible	15
Concealed	10
Shales, very sandy, **Ames**, no fossils seen	9
Coal, digging closed, reported 2' to	3
Concealed	

Judging from the small amount of coal found on the dump at the above prospect, the bed was evidently too thin and slaty to be successfully worked for even local domestic fuel.

Four-tenths mile due north in the same District (Salt Lick), Gawthrop examined the following prospect:

Coal Prospect—No. 27 on Map II.

On west hillside of Saltlick Creek; **Harlem Coal**; elevation, 835′ B.

	Feet.
Sandstone, massive, greenish-gray, **Grafton**, visible	25
Shale, siliceous, gray, **Ames**, no fossils seen	5
Coal, **digging closed**, black cannel-slate on dump	..

In the northern edge of Holly District (Braxton), **Coal Prospect No. 28 on Map II,** located on south hillside of Right Fork, 1.5 miles east of Flatwoods, at an elevation of 1030′ B., was closed so that the thickness of the Harlem bed could not be obtained. The black roof slate on the dump appears to carry marine fossils, although the forms are very indistinct.

One mile westward on the same hillside, the writer obtained the following data at an exposure of this coal:

Coal Exposure—No. 29 on Map II.

Salt Lick District, 0.4 mile east of Flatwoods; **Harlem Coal**; elevation, 1040′ B.

	Ft.	In.
Sandstone, shaly, **Grafton**	25	0
Shale, green, argillaceous, plant fossils, no marine fossils seen, **Ames**	5	0
Coal, slaty, **Harlem**, with trace of marine? fossils at top	0	4
Fire clay shale, with flinty streaks	7	0

In the eastern edge of Otter District (Braxton), at **Coal Exposure No. 30 on Map II,** located along the hill road on the head of Brushy Fork of Granny Creek, 1.4 miles westward from McNutt, only one inch is visible, at an elevation of 1045′ B., about 330 feet below the horizon of the Pittsburgh Coal bed, as determined by the writer.

At **Coal Opening No. 17 on Map II,** located in Birch District (Braxton) on the head of Diatter Run, the Harlem Coal attains the maximum development observed, its thickness and stratigraphic position at this point being shown in the Twistville-Diatter Run Section, pages 83-4.

It is quite evident from a careful study of the foregoing data on the Harlem Coal that this bed is too thin, irregular, and impure to warrant classification as a minable seam.

THE EWING LIMESTONE.

The Ewing Limestone of the Ohio Geological Survey, belonging 1 to 15 below the coal last described, was observed at many exposures in the territory of this Report where it is generally nodular, brecciated, and somewhat shaly, although sometimes represented by a single ledge of fairly pure limestone. Its thickness and stratigraphic position are exhibited in the special sections published in Chapter IV for Berry Siding, Sutton—1 Mile North, Sutton—1 Mile Northwest, Sutton—½ Mile Northwest, Sutton—Southeast Edge, Strange Creek, and Head of Mill Run, all in Braxton County.

In **Salt Lick District (Braxton)**, this ledge is gray and hard, 18 inches in thickness, at an elevation of 860′ B., at its outcrop on the north side of the public road, ¼ mile southwest of Napier.

In the same District on the head of Pickles Fork of Saltlick Creek, ¾ mile south of the mouth of Tyler Run, the Ewing Limestone, nodular and brecciated, is 2 to 3 feet in thickness, at an elevation of 1260′ B., 90 feet above an opening in the Bakerstown Coal, as determined by the writer who also measured the following section at another exposure of this ledge on the north hillside of Saltlick Creek, 0.4 mile east of Saltlick Bridge P. O.:

	Ft.	In.
Sandstone, medium-grained, green, **Grafton**	15	0
Shale, reddish-green, **Ames**, no fossils seen	6	0
Coaly slate, **Harlem**	0	10
Fire clay shale	0	4
Limestone, nodular, lenticular, Ewing, (900′ B.)	1	0

In the southwestern corner of the same District, Gawthrop measured the following section at the crop of this limestone in a Baltimore and Ohio Railroad cut, 0.2 mile north of Heaters.:

	Feet.
Shale, greenish-gray and red	10
Limestone, gray, hard, Ewing, (865′ B.)	1
Shale, gray and siliceous	10
Sandstone to railroad grade	5

About 3 miles farther down Saltlick Creek, Gawthrop measured the following section in a Baltimore and Ohio Railroad cut, 0.4 mile northwest of the mouth of Grass Run:

				Ft.	In.
Fire clay and coal, **Harlem**, visible				1	0
Shale, greenish-gray and reddish-brown				10	0
Limestone, gray and hard	0'	4"			
Shale, gray and brown	1	0			
Limestone, nodular, gray	0	10			
Shale, red	0	6			
Limestone	0	6	**Ewing** (770' B.)	3	2
Shale, gray and red, to railroad grade				2	0

In **Otter District (Braxton)**, the writer measured the following section at an exposure of this limestone on the west bank of Walnut Fork, just above the mouth of the latter, 1.3 miles northeast of Gassaway:

	Feet.
Sandstone, **Morgantown**	50
Concealed	65
Sandstone, **Grafton**	25
Concealed and shale	22
Limestone, nodular, brecciated, Ewing (840' B.)	3

At the above exposure, the Ewing belongs about 410 feet below the horizon of the Pittsburgh Coal bed. In the western border of the same District, Gawthrop measured the following section at its outcrop along the hill road on the head of Sugarcamp Run, 0.3 mile northwest of Clickton:

	Feet.
Shale, red, visible	24
Limestone, nodular, Ewing, (1165' B.)	1
Shale, red	3
Sandstone, hard, visible	2

On the south side of Elk River in the same District (Otter), the writer measured the following section at its outcrop in the hill road on the west side of Buffalo Creek, 2.4 miles southwest of Sutton and 0.6 mile northwest of the mouth of Cunningham Fork:

	Feet.
Shale, red, visible	15
Limestone, brecciated, nodular, Ewing, (1195' B.)	5
Shale, red and green, **Pittsburgh**	20
Concealed	25
Sandstone, coarse, **Jane Lew**	15
Shale, red, visible	5

In **Birch District (Braxton)**, the Ewing Limestone is quite persistent, the following section, determined by Gawthrop with aneroid, occurring along the hill road on the head of Lower Rockcamp Run:

				Ft.	In.
Shale, red, with iron ore nuggets				6	0
Limestone, gray	0'	6"			
Shale, gray, siliceous	6	0			
Limestone, gray and hard, quite pure	2	0	Ewing (1050' B.)	8	6
Shale, gray, siliceous				10	0

The following section was measured with aneroid by Gawthrop at its crop in the hill road on the head of Mill Creek, slightly over a mile northwest of the summit of Coon Knob:

	Feet.
Shale, gray	..
Limestone, gray, nodular	1
Concealed and red shale	21
Shale, green	2
Limestone, gray, siliceous, Ewing, (1215' B.)	2
Shale, greenish-gray	3
Sandstone, shaly	6

In the eastern edge of the same District (Birch), Gawthrop measured with aneroid the following section along the hill road on the head of Middle Run, 0.6 mile south of Coon Knob:

				Ft.	In.
Shale				..	..
Limestone, gray	1'	0"	Ewing (1360' B.)	4	6
Shale, greenish-gray	3	0			
Limestone, gray	0	6			
Shale, siliceous				5	0
Sandstone, shaly	27'		Jane Lew	37	0
Sandstone, hard, massive	10				

At the above exposure, the limestone belongs about 400 feet above the horizon of the Upper Kittanning Coal.

In the southwestern edge of Birch District, the **Ewing Limestone** was once quarried on the land of F. A. Frame near the summit of a knob on the north side of Elk River, 1.3 miles northwest of Strange Creek, at an elevation of 1205' B., the stone being used for flux in the old iron furnace at the latter town, according to information given the writer by F. A. Frame, who states this ledge was quarried for the same purpose on the south side of Elk, 1 mile west of Strange Creek, at an elevation of 1235′ B., as determined with aneroid by the writer, Mr. Frame reporting it 3 to 4 feet in thickness at this point.

One mile due north of the mouth of Frame Run of Strange Creek, the **Ewing Limestone** crops along the ridge road at an elevation of 1230′ B., as determined by the writer. Here it is gray, hard, and siliceous, and attains a thickness of almost 10 feet.

In **Holly District (Braxton),** the Ewing Limestone is fairly persistent. It is 3 feet in thickness, brecciated, and nodular at its outcrop at an elevation of 1345′ B., along the ridge road, 1.1 miles N. 20° W. of Newville, as determined by the writer. In the northern edge of the same District, Gawthrop measured with aneroid the following section at an exposure of this ledge along the hill road, 0.2 mile southeast of the summit of High Knob:

	Feet.
Shale	..
Coal, trace, Harlem	..
Shale, red, concealed, and red shale	15
Limestone, nodular, siliceous, gray, Ewing, (1525′ B.)	1.5
Shale, red	5
Sandstone and concealed	106
Coal opening, Bakerstown, on land of Virginia Ware	2.6

In **Otter District (Clay),** only one exposure of the **Ewing Limestone** was observed, this being in the public road, 1.2 miles northeast of the extreme western point of the District, where it is nodular, brecciated, siliceous, and 3 to 5 feet in thickness, coming at an elevation of about 940′ B., approximately 340 feet below the Pittsburgh Coal bed, as determined by the writer. A sample for analysis was collected at this point, the composition of which, as reported by Messrs. Hite and Krak under Laboratory No. 899H, is published on a subsequent page in Chapter XI.

THE PITTSBURGH RED SHALE.

The Pittsburgh Red Shale of White[17], belonging between the limestone last described and the Saltsburg Sandstone in the northern border of the State, is very persistent in both Braxton and Clay, being composed of red and variegated shale, generally divided into two separate beds by the Jane Lew Sandstone and ranging in thickness from 40 to 60 feet. Here it has lost the distinction of being the lowest "reds" of the Conemaugh Series, since, as already mentioned on a preceding page, this type of shale extends more than 100 feet lower in the measures, largely replacing both the Saltsburg and Buffalo Sandstones. Its thickness and stratigraphic position are exhibited in the special sections in Chapter IV for Burnsville, Sutton—Southwest Edge, Sutton—Southeast, Rosedale, and Sleith—1.7 Miles Northeast; in the logs of oil and gas test borings Nos. 95 and 104 on Map II; and the log of Coal Test Boring No. 5 on Map II. As it belongs only 40 to 50 feet above the Bakerstown Coal, its outcrop follows practically the same regions as that outlined for the latter bed on the map last mentioned. In other Counties of the State, it has a fine reputation for the manufacture of both building and paving brick, and its wide exposures at outcrop should furnish an unlimited supply of material for the same purpose in the territory of this Report. Gawthrop collected two samples of this shale—one for chemical analysis and the other for brick tests—at an exposure along the Coal and Coke Railway on Brushy Branch of Little Otter Creek, 1.5 miles northeast of Gassaway. Both the section and the results of the tests will be given on subsequent pages in Chapter XI under "Stratified Shale".

THE JANE LEW SANDSTONE.

The Jane Lew Sandstone of Reger[18], belonging at its type locality—Jane Lew, Lewis County—15 to 25 feet below the top of the member last described, frequently develops into a massive ledge, 20 to 40 feet in thickness in the territory of this

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[17] I. C. White, Bull. 65, U. S. Geol. Survey, p. 92; 1891.

[18] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, pp. 153-4; 1916.

Report, generally being medium-grained, micaceous, and greenish-gray in color. In the special sections in Chapter IV for Herold—Northeast Edge, in Braxton County; for Big Otter—0.5 Mile Southeast in Clay; and in the section given on a preceding page of this Chapter under the description of the Morgantown Sandstone. No quarries were observed on this ledge and it is doubtful whether it would give satisfactory results as a building stone in exposed surfaces, since it is often more or less shaly and usually carries considerable aluminous material.

THE SALTSBURG SANDSTONE.

The Saltsburg Sandstone of Jno. J. Stevenson, named from its occurrence at Saltsburg, Pennsylvania, belonging just above the Bakerstown Coal and ranging from 15 to 45 feet in thickness, is generally present, although frequently replaced to a large extent by red shale in southwestern Braxton and northern Clay. Its thickness and stratigraphic position are shown in the special sections published in Chapter IV for Bulltown, Gregory, Gassaway—Northwest Edge, Sutton—1 Mile Northwest, Sutton—½ Mile Northwest, Herold—Northeast Edge, and High Knob, in Braxton; for Big Otter—0.5 Mile Southeast, Wallback, and Clay, in Clay County; and in the logs of oil and gas test borings Nos. 74, 85, 86, 89, 94, and 109A on Map II. Its outcrop is confined to practically the same regions as that outlined above for the Pittsburgh Red Shale. No quarries were observed on this ledge in either County, although in other portions of the State, near Kingwood, it has a great reputation for beauty, durability, and fire-proofness, as described on pages 391-4 of the Preston County Report. However, in the territory of this Report, this stratum is not nearly so hard and quartzitic in texture as in the Kingwood region, but its wide exposure at outcrop should furnish an abundance of stone adapted for foundations and general highway construction work.

THE BAKERSTOWN COAL.

The Bakerstown Coal of White[19], belonging just below the sandstone last described and 425 to 450 feet below the Pittsburgh Coal bed, is a persistent and valuable seam in Salt Lick and Holly Districts, Braxton County, its approximate minable area being shown on Figure 5 on a subsequent page in Chapter X on Coal. It is generally multiple-bedded and of a medium-hard gas type, in its maximum development seldom exceeding 5 feet in thickness. Its stratigraphic position is exhibited in the special sections published in Chapter IV for Orlando, Knawl—0.3 Mile Southeast, Bulltown, High Knob, Rosedale, and Gassaway—2 Miles West; and in the log of oil and gas boring No. 47 on Map II, the latter being located on Left Fork of Saltlick Creek, 1.7 miles southwest of Cogers (Gem P. O.). Its crop in those regions where it is believed or known to be of minable dimensions and regularity is outlined on Map II, and its thickness, chemical character, together with many detailed bed-sections obtained at exposures, prospect openings, and country banks, will be given in Chapter X on Coal.

THE PINE CREEK LIMESTONE.

The Pine Creek Limestone of White[20], belonging 20 to 40 feet below the coal last described, and frequently carrying marine fossils in abundance in the northern counties of the State, was seen at only one exposure in the territory of this Report; viz, on the south hillside of Elk River, just above Strange Creek town, its thickness and stratigraphic position here being exhibited in the section published in Chapter IV for the latter point, pages 87-8.

THE BUFFALO SANDSTONE.

The Buffalo Sandstone of White[21], belonging 20 to 40 feet below the Bakerstown Coal and just above the marine fossiliferous Brush Creek Shale, like the Saltsburg ledge, is generally present, although frequently replaced to a large extent by red shale in southwestern Braxton County and northern Clay, a feature that has led to some confusion in the correlation of the basal members of the Conemaugh Series in this region in former State Reports. It is usually massive, medium-grained to coarse-, micaceous, gray to bluish-gray in color, ranging in thickness from 10 to 60 feet. Its stratigraphic position is exhibited in the special sections published in Chapter IV for Bulltown, Gassaway—Northwest Edge, Sutton—½ Mile Northwest, Sutton—Southeast Edge, Rosedale, Frametown—Eli Taylor Knob, and Sutton, in Braxton; Big Otter—0.5 Mile Southeast, Wallback, Pilot Knob, and Clay, in Clay County; in the logs of oil and gas test borings Nos. 74, 100, and 109A on Map II; and the logs of Coal Test Borings Nos. 5 and 6 on the same map. Since it belongs only slightly over 100 feet above the base of the Conemaugh Series, its outcrop follows practically the same regions as that outlined on Map II for the junction line of the latter Series and the Allegheny. The writer obtained the following data at a quarry in what appears to be this ledge:

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[19] I. C. White, Report Q, Sec. Geol. Survey of Penna.
[20] I. C. White, Report Q, Sec. Geol. Survey of Penna.
[21] I. C. White, Report Q, Sec. Geol. Survey of Pennsylvania.

Dr. A. H. Kuntz Sandstone Quarry.

Located on the east bank of Old Woman Run, 1¼ miles northeast of the Court-House at Sutton; Buffalo Sandstone; elevation, 960′ B.

	Feet.	
Sandstone, platy, current-bedded, medium-grained, micaceous, bluish-gray	6	
Sandstone, massive, medium- to coarse-grained, bluish-gray, quarry ledge	12	18

The quarry-face was driven back into the hill 5 to 15 feet, and extends along Old Woman Run for 200 to 250 feet. Owing to the comparatively gentle slope, the expense of soil removal is slight. The stone presents a very attractive appearance, splitting readily into blocks of any desired size, and was used in the construction of the Brown Building in the town of Sutton.

THE BRUSH CREEK LIMESTONE AND SHALE.

The Brush Creek Limestone of White[22] and the Brush Creek Shale of the writer[23], occupying the 5 to 10 feet of interval separating the sandstone last described from the underlying Brush Creek Coal, appear to be represented only by the Shale in Braxton and Clay Counties, its outcrop being confined to practically the same region as outlined for the Buffalo Sandstone. It is usually dark-gray to black and carries marine fossils, being well exposed along the Elk and Little Kanawha Railroad grade, 0.4 mile southwest of the mouth of Little Otter Creek. At the latter point, its thickness and stratigraphic position are exhibited in the Gassaway—Northwest Edge Section, page 66.

The writer measured the following section at its exposure along the north edge of the public road on the north side of Elk River, 0.5 mile southeast of the mouth of the creek last mentioned:

	Ft.	In.
Shale, dark-green, argillaceous, marine fossils, Brush Creek, visible	1	0
Coal, slaty, Brush Creek	0	5
Fire clay shale	10	0
Sandstone, limy, weathering rounded	6	0
Shale, reddish, to road bed	2	0

The two exposures cited above are the only ones in which marine fossils were observed at this horizon.

THE BRUSH CREEK COAL.

The Brush Creek Coal of White[24], belonging immediately below the members last described, occurs frequently in Braxton, but was not observed in Clay County. It is generally thin and impure, seldom exceeding 1 foot in thickness. Its dimensions and stratigraphic position are exhibited in the special sections in Chapter IV for Bablin, Bulltown, Gassaway—2 Miles West, Gassaway—Northwest Edge, Sutton—

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[22] I. C. White, Report Q, Second Geol. Survey of Pennsylvania.

[23] Ray V. Hennen, Monongalia-Marion-Taylor Report, W. Va. Geol Survey, p. 310; 1913.

[24] I. C. White, Report Q, Second Geol. Survey of Pennsylvania.

Southeast Edge, Frametown—Eli Taylor Knob, and Herold; in the logs of oil and gas test wells Nos. 2, 25, and 93 on Map II; and in the record of Coal Test Boring No. 6 on Map II.

In **Salt Lick District** (Braxton), Gawthrop obtained the following data at an exposure of this bed:

Coal Prospect—No. 31 on Map II.

On north bank of Left Fork of Knawl Creek, 1.7 miles northwest of Ireland; **Brush Creek Coal**; elevation, 1040' B.

		Feet.
Sandstone, massive, gray, **Buffalo**, visible		5
Shale, bluish-gray, **Brush Creek**		2
Coal	1' 0"	
Coal, concealed, reported	0 6	1.5
Shale		

The following exposure in the same District was examined by the writer:

Coal Exposure—No. 32 on Map II.

In hill road, 0.7 mile southeast of Letch; **Brush Creek Coal**; elevation, 1190' B.

	Feet.
Sandstone, current-bedded, medium-grained, grayish-brown and white, **Buffalo**	45
Coal, Brush Creek	0.2
Fire clay shale and concealed	

In **Otter District (Braxton),** Gawthrop reports the Brush Creek Coal about 2 feet in thickness at the **James McLaughton Coal Opening—No. 33 on Map II,** on the west bank of Sugarcamp Run, opposite Clickton, at an elevation of 1022' L.

In **Birch District,** same county, Gawthrop obtained the following:

Richard Given Coal Prospect—No. 34 on Map II.

On the west hillside of Lower Mill Creek, 1 mile west of Rockton and 1¼ miles southwest of Frametown; **Brush Creek Coal**; elevation, 910' B.

	Ft.	In.
Sandstone, massive, brown and gray, medium-coarse, **Buffalo**, visible	2	0
Shale, gray, **Brush Creek**	0	10

			Ft.	In.
Coal, slaty	0'	4"		
Coal, shaly	0	8	1	0
Fire clay and concealed			10	0
Sandstone, massive, Upper Mahoning, visible			10	0

In the same District, at **Coal Exposure—No. 35 on Map II,** in the hill road on the west side of Tate Creek, 1.4 miles northwest of Glendon, this coal is only eight inches in thickness and impure, at an elevation of 955' B., as determined by the writer.

The following opening was examined by the writer, the section being furnished by Mr. Nottingham:

Troy Nottingham Coal Opening—No. 36 on Map II.

In head of run, 1¼ miles due east of Villa Nova; **Brush Creek Coal**; elevation, 1050' B.

			Ft.	In.
Coal, slaty	0'	8"		
Coal, good	1	4	2	0

In the extreme southeastern edge of Birch District, Gawthrop reports the **Brush Creek** one foot in thickness at **Coal Exposure—No. 37 on Map II,** in the hill road, 2 miles southwest of Herold, and 0.3 mile northwest of Wade, at an elevation of 1460' B.

In the northern edge of **Holly District** (Braxton), Gawthrop reports the Brush Creek 15 inches in thickness at **Coal Exposure—No. 38 on Map II,** located on the east bank of Saltlick Creek, 1.7 miles southeast of Flatwoods, and 0.2 mile northeast of the Baltimore and Ohio Railroad trestle over the latter stream.

It is quite evident from the foregoing data that the Brush Creek Coal is too thin and impure to be classed as minable in the territory of this Report.

THE UPPER MAHONING SANDSTONE.

The Upper Mahoning Sandstone of Rogers and White[25], belonging in the interval separating the stratum last described and the underlying Mahoning Coal, and ranging in thickness from 25 to 60 feet, is widely persistent in the territory of this Report. It is generally massive, coarse to pebbly, grayish-brown in color, and is often a conspicuous cliff-former. Its thickness and stratigraphic position are exhibited in 16 of the special sections given in Chapter IV; in the logs of oil and gas test wells Nos. 2, 86, 89, 109A, and 169 on Map II; and in the records of Coal Test Borings Nos. 5 and 47 on Map II. Since it belongs only 50 to 60 feet above the base of the Conemaugh, its outcrop follows closely the same regions as that indicated on Map II for the division line between the latter Series and the Allegheny. It is this stratum that was once worked at the **Dr. M. T. Morrison Quarry** in Sutton, County-Seat of Braxton, at an elevation of 875′ B. Here it is massive, medium-grained to coarse-, gray to grayish-brown, the quarry-face being 25 to 30 feet high, 100 to 125 feet long and worked back into the hill a distance of 15 to 20 feet, as determined by the writer.

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[25] I. C. White, Volume II, W. Va. Geol. Survey, p. 305; 1903.

It was also **quarried** just opposite Frametown, stone from it being used in the abutments for the public highway bridge over Elk River at this place, according to Gawthrop, who measured the following section here:

	Feet.
Sandstone, flaggy, visible	2
Sandstone, massive, medium-grained, gray, quarry ledge, Upper Mahoning, (905′ B.)	8
Shale, gray, siliceous, partly concealed, holding Sutton Limestone	15
Sandstone, massive and concealed	70
Shale, siliceous, Uffington	6
Coal, Upper Freeport	1.6

Three and a half miles southwestward in the same District, it is the Upper Mahoning Sandstone that was once operated at the **Austen Long Quarry**, on the east hillside of Birch River, 0.3 mile southeast of Glendon, at an elevation of 1000′ B., as determined by the writer. Stone from it was used in the construction of the Coal and Coke Railway bridge over the latter stream, and it is coarse, medium-hard, grayish-brown, with a corn-meal appearance on fresh fracture. The quarry-face is 10 feet high, 100 to 125 feet long, and driven back into the hill 15 to 20 feet. The quarry is not now in operation.

THE SUTTON LIMESTONE.

Just east of the Baltimore and Ohio Railway Station at Sutton, there occurs a calcareous stratum in the interval separating the ledge last described and the underlying Mahoning Coal, that has not been previously described. It is herein designated the **Sutton Limestone.** On fresh fracture, it is dark-gray in color, weathering to a yellowish-gray, being more or less lenticular and somewhat siliceous and seldom exceeding 2 feet in thickness. Its dimensions and stratigraphic position are exhibited in the special sections in Chapter IV for Sutton—Southwest Edge, Sutton—Southeast Edge, Sutton, Gassaway—Northwest Edge, Gassaway—2 Miles West, and Frametown—Eli Taylor Knob; and in the log of Coal Test Boring No. 47 on Map II, 2.1 miles westward from Warfield.

In **Saltlick District** (Braxton), Gawthrop measured the following section at its exposure in the public road, 0.2 mile southeast of Knawl:

	Feet.
Sandstone, flaggy, greenish-gray, **Upper Mahoning**, visible	10
Shale, dark, siliceous	5
Limestone, Sutton, hard, gray, (840′ B.) 12″ to	1.5
Shale and concealed	

Gawthrop reports the same ledge at the base of a cliff at Knawl, at an elevation of 825′ B.

In the eastern edge of **Otter District** (Braxton), the writer obtained the following at its outcrop in the public road on the north side of Elk River, 1¼ miles due west of Sutton:

	Feet.
Sandstone, massive, pebbly, **Upper Mahoning**	50
Concealed and sandstone	21
Shale	3
Limestone, yellowish-gray, Sutton (825′ B.), 8″ to	1.2
Shale	

Four-tenths mile southwestward in the same District, the writer measured the following section at its crop along the Coal and Coke Railway grade, at an elevation of 825′ B.:

	Feet.
Sandstone, massive	10
Shale, sandy	2
Shale, dark	0.1
Fire clay shale	1.9

	Feet.
Shale, sandy	6
Sandstone, bluish-gray, fine-grained	7
Shale, bluish-gray, to railroad grade	4
Limestone, lenticular, weathering yellow, Sutton, 0" to	3

Three-tenths mile west of Bison, in the same District, the writer measured the following section at its crop in a Coal and Coke Railway cut, at an elevation of 860′ B.:

	Feet.
Sandstone and sandy shale	10
Limestone, yellowish-gray, Sutton, 18" to	2
Shale, limy	4
Sandstone, shaly	9
Shale, dark, and fire clay	2
Sandstone, massive, medium-grained, micaceous, greenish-gray, to railroad grade	15

It is this limestone, 1 to 2 feet in thickness, that crops in a cut 15 feet above the same railway grade, 1.5 miles southeast of Gassaway, just above the mouth of Bear Run, at an elevation of 845′ B.

Slightly over a mile southwest of Gassaway and 0.9 mile northwest of the mouth of Bear Run, the writer measured the following section at the crop of this ledge in a Coal and Coke Railway cut, at an elevation of 830′ B.:

	Feet.
Sandstone, massive, visible, **Upper Mahoning**	10
Shale, sandy, with sandstone	12
Limestone, Sutton, weathering yellow, but gray on fresh fracture	1

One-half mile westward along the same railway grade, the writer obtained the following at another exposure of this limestone:

	Feet.
Sandstone, massive, coarse, pebbly, **Upper Mahoning**	
Concealed	15
Limestone, gray and hard, Sutton, (15") (865′ B.)	1.3
Shale, brown and sandy	15
Sandstone, massive	5
Shale, bluish-gray, with large **lenses of iron ore,** 2" to 12" in diameter, abundant	10
Sandstone, grayish-white, **Lower Mahoning,** to railroad grade	5

A sample of the **iron ore** was collected from the above exposure, the composition of which, as reported by Messrs.

Hite and Krak under Laboratory No. 891H, is given on subsequent pages in Chapter XI.

On Sugarcamp Run, 0.8 mile up from the mouth, Gawthrop measured the following section at an exposure of this limestone in the public road:

		Feet.
Sandstone, massive, coarse, gray...15' Sandstone, massive, with shale layers 18	Upper Mahoning..	33
Shale, sandy		2
Limestone, hard, yellow, Sutton (875' B.)		1.5
Sandstone, hard		4

In **Birch District** (Braxton), Gawthrop reports the Sutton Limestone 1 foot in thickness, gray and hard, weathering yellow, at an exposure in the bed of Lower Mill Creek, 1.3 miles northwest of Rockton, at an elevation of 865′ B.

In the eastern edge of the same District, Gawthrop measured the following section at an exposure of 2¼ miles northeast of Frametown and slightly less than a mile up Lower Rockcamp Run:

	Feet.
Sandstone, Upper Mahoning, visible	5
Shale, gray	5
Limestone, gray and hard, Sutton (870' B.) 1' to	2
Shale and concealed to sandstone	10

In **Holly District,** same county, the writer collected a sample of the Sutton Limestone for analysis and measured the following section at its crop along the public road 2.7 miles east of Flatwoods and 1.1 miles southward from Corley:

	Feet.
Sandstone, shaly, Upper Mahoning, visible	10
Limestone, Sutton, gray and hard, weathering yellow, (900' B.), 18" to	2
Shale	4
Sandstone	6
Shale, green and sandy	3
Shale, dark	1.5
Fire clay shale, Thornton, to road	1

The composition of the sample, as reported under Laboratory No. 886H, will be given on subsequent pages in Chapter XI under "Limestone".

In the western edge of Holly District, the writer measured the following section at its outcrop on the east bank of Granny Creek, 0.8 mile above the mouth of Brushy Fork:

	Feet.
Sandstone, massive, pebbly, making cliff, **Upper Mahoning**	50
Shale, dark, argillaceous, with iron ore lenses	20
Limestone, Sutton, ferriferous, weathering yellow, (955' B.), 6" to	1
Shale, dark, with lenses of iron ore, to bed of Granny Creek	10

In the same District, Gawthrop measured the following section at the crop of the Sutton Limestone just east of the railway station at Sutton:

	Feet.
Shale, visible	2
Limestone, hard, dark-gray, weathering yellow, (6" to 8")	0.7
Shale, greenish-gray	5
Limestone, Sutton, gray and hard on fresh fracture, weathers very yellow (845' B.)	1.5
Shale, red and green	4
Sandstone	2
Shale, siliceous	5
Fire clay, dark, **Thornton**	1

In **Otter District**, Clay County, the writer measured the following section at an exposure of this ledge on the north side of Butler Fork, one-third mile west of the mouth of Wilson Fork:

	Ft.	In.
Sandstone, shaly, visible	15	0
Shale, sandy and green	3	0
Shale, red	1	3
Limestone, Sutton, weathering yellow, (840' B.)	0	8
Shale	2	0
Shale, dark	0	2
Fire clay shale to bed of Butler Fork	2	0

In **Union District,** same county, the Sutton Limestone is 6 inches in thickness at an exposure in the hill road, 1.2 miles northeast of Procious, coming here 80 to 90 feet above the top of the Upper Freeport Sandstone and at an elevation of 1080' B.

In the territory of this Report, this limestone appears too thin and irregular to be of any special economic importance, but it served as an important "key-rock" in carrying the Upper Freeport Coal horizon down Elk River from Sutton to Strange Creek.

THE MIDDLE MAHONING SANDSTONE.

In the eastern border of Otter District, Braxton County, an arenaceous stratum was once quarried on the east bank of

Buffalo Creek, just southeast of Bison Station on the Coal and Coke Railway, that has not been previously described. It belongs in the interval separating the Upper and Lower Mahoning Sandstones and between the Sutton Limestone and Mahoning Coal, and for that reason it is herein designated the **Middle Mahoning Sandstone.** The following data were obtained by the writer at the quarry in question:

Fred Sawyer Sandstone Quarry.

				Ft.	In.
Sandstone, massive, visible, Upper Mahoning				5	0
Shale				3	0
Limestone, Sutton, lenticular				1	0
Sandstone, massive, medium-grained, micaceous, bluish-gray, Middle Mahoning				11	0
Shale, brown and sandy				3	0
Shale, green, dark, argillaceous				4	0
Coal, gas	0'	7"	Mahoning (Opening No. 39 on Map II.)	1	9
Shale, gray, 2" to	0	3			
Coal, gas, 2" to	0	3			
Shale, gray	0	3			
Coal, hard, bony	0	5			
Slate					

Stone from this quarry was used in the construction of the Coal and Coke Railway bridge over Buffalo Creek in the immediate vicinity. Its stratigraphic position is also exhibited in the log of Coal Test Boring No. 47 on Map II, the details of which are published on subsequent pages in Chapter X.

THE MAHONING COAL.

The Mahoning Coal of White[26], belonging in the interval separating the Upper and Lower Mahoning Sandstones and 5 to 10 feet below the limestone last described, is of frequent occurrence in the territory of this Report. It is generally multiple-bedded and rarely attains minable purity, regularity, and dimensions. Its outcrop is confined to practically the same region as that outlined for the Upper Freeport bed on a subsequent page. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Centralia—3.5 Miles East, Sutton, Buckeye Creek, Jennings—0.4 Mile Southeast, Strange Creek—1 Mile Northwest, and

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[26] I. C. White, Bull. 65, U. S. Geol. Survey, p. 96; 1891.

Frametown—¾ Mile Northeast, in Braxton County, and for Wallback in Clay; and in the log of Coal Test Boring No. 47 on Map II, 2.1 miles westward from Warfield, in Union District, Clay County.

In Salt Lick District (Braxton), no coal was observed at the outcrop of this horizon, but in Otter, its thickness and character at the **Fred Sawyer Opening—No. 39 on Map II,** is exhibited in the section given above under the description of the Middle Mahoning Sandstone.

One mile and a half southeastward in the same District on Buffalo Creek, the writer measured the following section at **Coal Exposure—No. 40 on Map II,** at the crop of the Mahoning bed in the public road 0.1 mile north of the mouth of Cunningham Fork:

	Feet.
Shale, sandy, visible	4
Fire clay shale, gray	3
Coal, medium-soft, Mahoning, (945' B.)	1
Shale, sandy	3
Sandstone, massive and shaly, greenish-brown, Lower Mahoning	25
Shale and concealed	5
Coal, Upper Freeport	2

In Birch District (Braxton), the Mahoning Coal was observed at several points, the following exposure being examined by Gawthrop:

Coal Exposure—No. 41 on Map II.

On west bank of Big Run, 1.1 miles northeast of Frametown.

	Ft.	In.
Shale, siliceous, and sandstone, flaggy, visible	10	0
Coal, slaty, Mahoning (880' B.)	0	4
Shale, dark	2	0
Shale, siliceous, brown	6	0
Sandstone, massive, Lower Mahoning, to Elk and Little Kanawha Railroad	5	0

One-half mile southward in the same District, it is only 1 inch in thickness at **Coal Exposure—No. 42 on Map II,** on the west hillside of Big Run, according to Gawthrop, as shown in the Frametown—¾ Mile Northeast Section, page 81.

In the southwest edge of Birch District, it is only 16 inches in thickness and slaty at the **F. A. Frame Prospect—No.**

43 on Map II, on the north hillside of Elk River, 1.4 miles eastward from Villa Nova, as exhibited in the Strange Creek—1 Mile Northwest Section, pages 88-9.

In the southern portion of Birch District, at **Exposure—No. 44 on Map II,** only fire clay shale is present at its horizon as shown in the Jennings—0.4 Mile Southeast Section, pages 90-1.

In Holly District (Braxton), the Mahoning Coal was observed at a number of exposures. On the west bank of Old Woman Run in the east edge of Sutton, its thickness and stratigraphic position with reference to the Sutton Limestone and the Upper Freeport Coal at **Coal Exposure—No. 45 on Map II** are shown in the Sutton Section, pages 94-5. On the east bank of the same stream, 0.4 mile northeastward, it is this seam that was prospected at **Coal Opening—No. 46 on Map II,** at an elevation of 860′ B. The digging was closed when visited by the writer in 1915, so that its thickness could not be determined, but judging from the evidence on the dump, not much coal was found.

One mile and a half southeast of Sutton in the same District, on the east hillside of Buckeye Creek, what appears to be the Mahoning bed, attains a thickness—including a 11-inch parting shale—of 3.2 feet at the **J. S. Freeman Coal Opening—No. 47 on Map II,** at an elevation of 1090′ B., as determined by Gawthrop. It is barely possible that this may represent the Brush Creek bed, since it seems to belong about 240 feet above the horizon of the Upper Kittanning Coal—the "key-rock" on which structure contours are based in this region. The prevailing rapid northwest dip makes it difficult to determine true intervals, however.

In the southeastern border of Holly District, at **Coal Exposure—No. 48 on Map II,** in the ridge road, 0.1 mile south of Holstad P. O., the Mahoning bed is only 12 inches in thickness and slaty, at an elevation of 1765′ B., as determined by the writer, 50 feet above the E. J. Hall opening in the Upper Freeport seam. In the same ridge road, 0.4 mile southeastward at **Coal Exposure—No. 49 on Map II,** the Mahoning bed crops at an elevation of 1815′ B., with practically the same thickness as at the exposure last described.

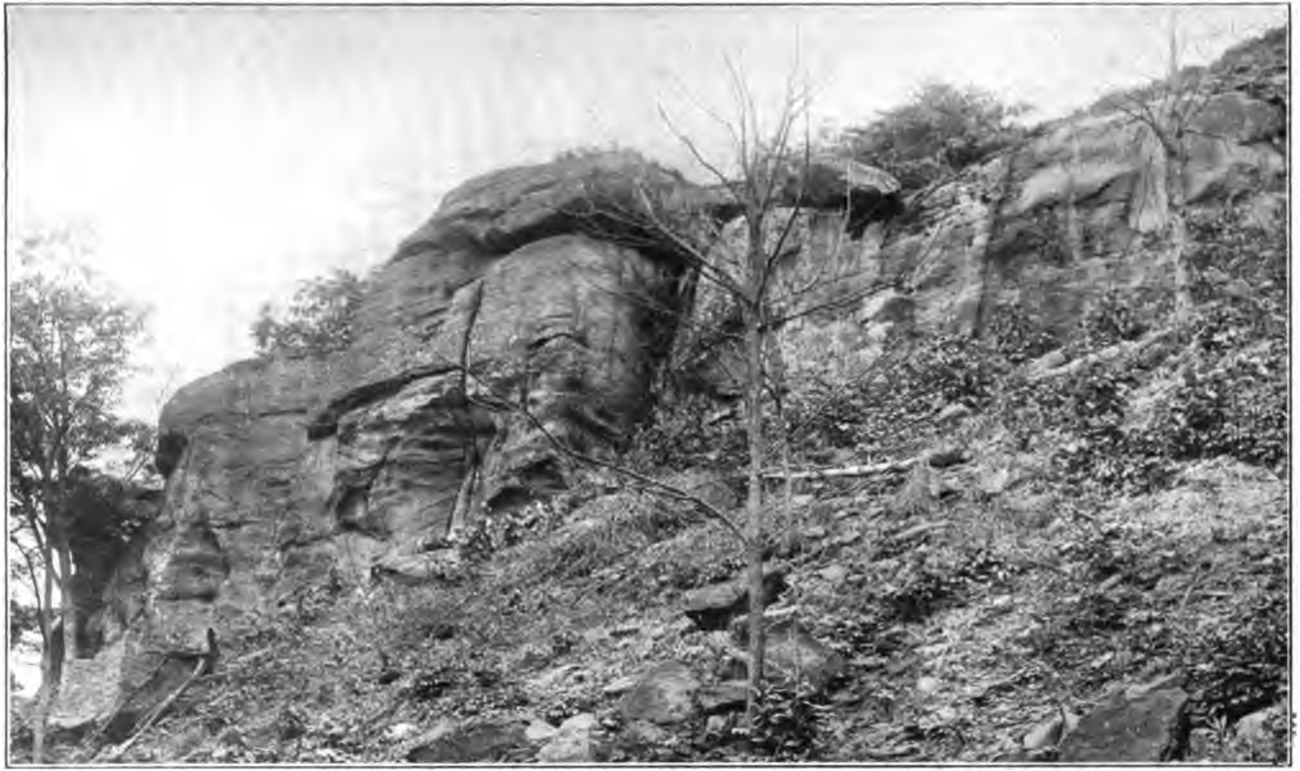

PLATE IX.—Showing outcrop of the great Sewickley Sandstone immediately northwest of Orlando.

In the southern point of Holly District, the writer obtained the following section at **Coal Exposure—No. 50 on Map II,** in the ridge road, 1.5 miles northwest of Waggy:

				Ft.	In.
Shale, gray, visible				0	6
Coal	0'	1 "	Mahoning (2030' B.)	1	6
Shale, gray	0	0½			
Coal	1	4½			
Shale				0	6
Sandstone, massive					

At **Coal Exposures Nos. 51 and 52 on Map II,** a short distance southeastward in the same ridge road, the Mahoning bed is 15 and 6 inches in thickness, at an elevation of 2060' B. and 2135' B., respectively, as determined by the writer.

In Clay County, the only exposures of the Mahoning Coal observed were in the northern point of Henry District. It is slightly less than 1 foot in thickness at **Coal Exposure No. 53 on Map II,** in the public road, just east of the mouth of Charleston Fork, 0.4 mile southeast of Wallback P. O., at an elevation of 760' B., as determined by the writer, its stratigraphic position here being shown in the Wallback Section, pages 121-2. On page 256 of the Wirt-Roane-Calhoun Report of the State Geological Survey, the writer erroneously correlated this exposure with the Bakerstown seam for reasons given in Chapter III and in connection with the section last mentioned.

It is the blossom of Mahoning bed that crops in the road 0.3 mile east of Camp Run, 1.3 miles southeast of Wallback at **Coal Exposure No. 54 on Map II,** at an elevation of 820' B., as determined by the writer. It is this bed that has been prospected at **Coal Opening No. 55 on Map II,** at the east edge of the road on Charleston Fork, 1.4 miles due south of Wallback, at an elevation of 865' B., the digging being so closed when visited by the writer in 1915 that its thickness and character could not be determined. However, judging from the debris on the dump, it does not occur in minable dimensions and purity.

Six-tenths mile southeastward along the same road on Charleston Fork, the Mahoning is only 3 inches in thickness at **Coal Exposure No. 56 on Map II,** at an elevation of 885' B., as determined by the writer.

In the same region, the following opening was examined by the writer:

Albert Stephens Coal Opening—No. 57 on Map II.

On south bank of Horse Run, 2 miles southeast of Wallback; Mahoning Coal; elevation, 845′ B.

			Ft.	In.
Shale, sandy				
Coal, bony	1′	0″		
Coal, bright, hard	0	10		
Bony cannel	0	1		
Coal, bright, hard	0	8		
Slate, black, hard	0	6		
Coal, hard, splinty	0	8	3	9
Slate, gray, pavement				

The foregoing is the thickest exposure of the Mahoning Coal observed in the territory of this Report, but even here it is more or less impure and split up with partings, so that as a whole it can hardly be classed as a minable seam in either county.

THE THORNTON FIRE CLAY.

The Thornton Fire Clay of White[27], belonging at its type locality—Thornton, Taylor County—just under the Mahoning Coal, appears to be represented by only an impure fire clay shale of doubtful economic value.

THE LOWER MAHONING SANDSTONE.

The Lower Mahoning Sandstone of Rogers and White[28], belonging in the interval separating the fire clay last described from the Uffington Shale, is very persistent in both counties, its thickness and stratigraphic position being shown in the special sections given in Chapter IV for Knawl, Gregory, Polemic Run, Sleith, Frametown, Jennings, Sutton, Palmer, and Holly in Braxton; and for Pilot Knob, Ivydale, Dundon, Camp, and Bomont, in Clay County; in the logs of oil and gas test wells Nos. 34, 76, 86, 91, 93, 94, 109A, and 169 on Map II; and in the log of Coal Test Boring No. 47 on Map II, the latter being located about 2 miles west of Warfield. Its outcrop follows closely the same region as that outlined on the same map for the division line between the Conemaugh and Allegheny Series. In both physical appearance and development, it resembles the Upper Mahoning ledge.

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[27] I. C. White, Vol. II, W. Va. Geol. Survey, pp. 322-323; 1903.

[28] I. C. White, Vol. II, W. Va. Geol. Survey, p. 305; 1903.

In Otter District (Braxton), it is this ledge that is quarried on the west bank of Little Buffalo Creek, 0.3 mile southward from Elk River at an elevation of 840' B., where the following data were obtained by Gawthrop:

		Feet.
Sandstone, flaggy	10'	
Shale, dark-gray	2	
Sandstone, massive, medium-grained, micaceous, gray	15	
Concealed to base of quarry	5	32

Stone from this quarry was used in the construction of the arch culvert of the Coal and Coke Railway across Little Buffalo just above the mouth of the latter creek.

In Holly District (Braxton), it is the Lower Mahoning that was once quarried on the east bank of Buckeye Creek, ¾ mile southeast of Sutton, at an elevation of 875' B., where Gawthrop reports it 25 feet thick, massive, coarse to very pebbly, brown in color, the stone from it being used in the construction of the retaining walls at the Coal and Coke Railway station at Sutton.

THE UFFINGTON SHALE.

The Uffington Shale of White[29], the basal member of the Conemaugh Series at its type locality—Uffington, Monongalia County—is of frequent occurrence in the territory of this Report, being usually dark-gray in color, carrying plant fossils and ranging in thickness from 0 to 5 feet. Its stratigraphic position is exhibited in the special sections in Chapter IV for Frametown — ¾ Mile Northeast, Frametown — Eli Taylor Knob, and Buckeye Creek, and the log of Coal Test Boring No. 6 on Map II, all in Braxton County. It is noted in many of the sections for the Upper Freeport Coal given on subsequent pages in Chapter X.

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[29] I. C. White, Vol. II, W. Va. Geol. Survey, p. 323; 1903.

CHAPTER VII.

STRATIGRAPHY—ALLEGHENY SERIES.

GENERAL DESCRIPTION AND SECTION.

The Allegheny Series of the Pennsylvanian, originally designated by the First Geological Survey of Pennsylvania from its occurrence along a river of the same name in the latter State, outcrops over an area in the territory of this Report second only to that of the Conemaugh, as shown by colored symbol on Map II. It extends from the base of the Uffington Shale down through the rock column to the top of the Homewood Sandstone, the top member of the Pottsville Series, and ranges in thickness from 250 feet in northeastern Braxton to almost 350 feet in southern and southwestern Clay County. The series consists of several sandstone ledges, alternating with buff to dark-gray sandy shales, fire clay shale, thin iron ore lenses, limestone of scanty occurrence and three or four minable coal beds. The following general section, compiled from those published in Chapter IV, in addition to a large number of other detailed observations, is representative of the Allegheny Series for the entire area under discussion:

General Section of the Allegheny Series in Braxton and Clay Counties.

	Thickness. Feet.	Total. Feet.
Coal, Upper Freeport, medium-soft, multiple-bedded	0 to 5	5
Fire clay shale, Bolivar	0 to 5	10
Limestone, Upper Freeport, lenticular, frequently replaced with 6" to 12" of "**Kidney**" **Iron Ore, Upper Freeport**	0 to 5	15

	Thickness. Feet.	Total. Feet.	
Sandstone, Upper Freeport, massive, coarse, conglomeratic, gray to grayish-brown, with large white and bluish-black quartz pebbles ¼" to 2" in diameter, forms great cliffs along Elk River, and is an important "key-rock"	50 to 68	83	
Coal, Lower Freeport, medium-soft, irregular, lenticular	0 to 2	85	85'
Fire clay shale and shale, sandy, with 5" to 10" of **"Kidney" Iron Ore, Lower Freeport**	10 to 15	100	
Sandstone, Lower Freeport, massive, coarse, grayish-brown, prominent cliff-maker in western Clay, where it is quite pebbly	25 to 32	132	
Coal, Upper Kittanning "Rider", mostly bony cannel and a split off the Upper Kittanning proper	1 to 3	135	
Shales, sandy	0 to 25	160	
Coal, Upper Kittanning, medium-soft, multiple-bedded	2 to 5	165	80'
Sandstone, Upper East Lynn, massive to current-bedded, medium-grained to coarse- and conglomeratic, large quartz pebbles, great cliff rock	50 to 77	242	
Coal, Middle Kittanning, multiple-bedded, medium-hard, with both gas and semi-splint layers	0 to 8	250	85
Sandstone, East Lynn, massive to current-bedded, medium-grained, seldom pebbly, forms great cliffs	25 to 67	317	
Coal, Lower Kittanning, "No. 5 Block", "Roaring Creek," multiple-bedded, hard block and splinty, with softer gas layers, mined commercially at Widen	4 to 8	325	75'
Sandstone, Kittanning	0 to 22	347	
Coal, Clarion, medium-soft	0 to 3	350	25'
Sandstone, Homewood, "Roaring Creek"			

DESCRIPTION OF MEMBERS, ALLEGHENY SERIES.

THE UPPER FREEPORT COAL.

The Upper Freeport Coal of the First Geological Survey of Pennsylvania—the topmost member of the Allegheny Series at its type locality near Freeport, Pennsylvania—is fairly persistent in Braxton and Clay although frequently being absent entirely as shown by many exposures of its crop. In Salt Lick, Holly, and Otter Districts, Braxton, it has been prospected considerably by natives for local domestic fuel, as also in Buffalo District, Clay County, but it seldom attains 3 feet in thickness and possesses a different bed-section from that in

Monongalia and Preston Counties, usually carrying a thin—½" to 2 inches—parting slate 2 to 6 inches below the top. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Knawl, Rosedale, Frametown, Jennings, Sutton, Buckeye Creek, and Centralia, in Braxton County, and for Villa Nova and Dundon, in Clay; in the logs of Coal Test Borings Nos. 6 and 47 on Map II; and in the records of oil and gas test wells Nos. 73, 109A, and 208 on Map II. Its outcrop wherever it is believed to be of minable thickness and regularity is indicated by an appropriate symbol on Map II, and that for its horizon, where its merchantable condition is doubtful, by the dividing line between the Conemaugh and Allegheny Series on the same Map. It has not been mined commercially in either county, but its thickness and character at country banks, prospect openings, and crop exposures, and its approximate minable area, as limited on Figure 6, are described on subsequent pages in Chapter X, along with an estimate of its available tonnage.

THE BOLIVAR FIRE CLAY.

The Bolivar Fire Clay, belonging immediately below the coal last described and so named from a town in Westmoreland County, Pennsylvania, where it has long been the basis of an important fire-brick industry, is generally represented by an impure or more or less siliceous fire clay shale of no special economic value in the territory of this Report.

THE UPPER FREEPORT LIMESTONE AND IRON ORE.

The Upper Freeport Limestone of the First Geological Survey of Pennsylvania, so named from its occurrence at the type locality of the coal of the same designation, was observed at only two points although many exposures of its horizon abound in each county, its horizon often being occupied by **thin lenses of Iron Ore.**

In the northern portion of Holly District (Braxton), the writer collected a sample for analysis and obtained the following data at the crop of this ledge on the east bank of Carpenter Fork of Saltlick Creek, 2.2 miles south of Corley:

P. R. Butcher Limestone Exposure.

	Feet.
Coal blossom, Upper Freeport, (990′ B.)	5
Sandstone, shaly	7
Shale, sandy	3
Limestone, hard, bluish-gray, Upper Freeport	5
Shale and concealed to bed of Carpenter Fork	3

The composition of the sample, as reported by Messrs. Hite and Krak under Laboratory No. 887H, is given on a subsequent page in Chapter XI, under "Limestone".

In Otter District (Braxton), the writer measured the following section at a crop exposure of this limestone in a Coal and Coke Railway cut on the south bank of Elk River, 0.4 mile eastward from the mouth of Sugarcamp Run and slightly less than 2 miles southwest of Gassaway:

				Ft.	In.
Sandstone, massive, pebbly, light-gray, Lower Mahoning				30	0
Coal	0′	0½″	Upper Freeport	1	8
Shale, dark-gray	0	1½			
Coal	0	2			
Shale, gray	0	0½			
Coal	0	2			
Shale	0	0½			
Coal, soft	1	1			
Fire clay shale, Bolivar				10	0
Limestone, siliceous, weathering yellow, Upper Freeport (835′ B.)				1	0

The latter and the one preceding are the two exposures of this limestone referred to above as the only ones seen in which limestone occurred in either county.

THE UPPER FREEPORT SANDSTONE.

The Upper Freeport Sandstone, named by Pennsylvania geologists from its occurrence in that State, and belonging between the stratum last described and the Lower Freeport Coal, is very persistent in the territory of this Report, probably attaining the best development found in West Virginia. Here, it is generally massive, coarse to conglomeratic, gray to grayish-brown, with large white and bluish-black quartz pebbles ranging from ¼″ to 2 inches in diameter. It is a prominent cliff-former along the valley walls of Elk River above Sutton and below Gassaway, and, as mentioned on preceding pages in Chapter III, served as a valuable "key-rock" in correlating the measures of Clay and southern Braxton. It ranges in thickness from 40 to 75 feet and frequently makes sheer cliffs 50 to 60 feet in height. As shown on Plate XV, it is this ledge that caps the high knob, on the south side of Elk River, 1 mile southwest of Groves. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV; in the logs of oil and gas wells Nos. 2, 25, 47, 48, 71, 72, 74, 75, 78, 85, 86, 87, 89, 94, 95, 100, 108, 109A, 111, 189, 202, 214, and 242 on Map II; and in the logs of Coal Test Borings Nos. 5, 6, and 47 on Map II. Its outcrop follows closely the same regions as that outlined on the same map for the division line between the Conemaugh and Allegheny Series.

In **Salt Lick District** (Braxton), the Upper Freeport Sandstone is present in normal development for the area, except that it is not so conglomeratic as farther to the southwest. Its thickness and character are shown in the sections given in Chapter IV for Head of Knawl Creek, Bablin, Gregory, and Cleveland. No quarries were observed on it, but it should crush into a fair aggregate for concrete in the construction of highway bridges.

In the southern portion of **Otter District** (Braxton), it is present in normal development, carrying large quartz pebbles in abundance and making many cliffs around the hillsides. Its thickness and character here are exhibited in the special sections given in Chapter IV for Polemic Run, Gravel Fork, and Mill Creek.

In **Birch District,** same county, it occurs in practically the same development as in Otter, as shown in the special sections in Chapter IV for Rosedale, Sleith, Frametown—Eli Taylor Knob, Herold—Northeast Edge, Herold—Southwest Edge, Glendon, Strange Creek, Strange Creek—1 Mile Northwest, Head of Mill Run, Jennings—½ Mile West, Jennings—0.4 Mile Southeast, and Jennings—2 Miles Southeast. It is this ledge that was once **quarried** at Rockton Station on the Coal and Coke Railway, just northeast of the mouth of Dry Fork, according to Gawthrop, who obtained the following section at this point:

			Feet.
Sandstone, massive, medium-grained, gray, to railroad grade	30'	Upper Freeport. (775' B.)	56
Sandstone, massive, medium-grained, gray	10		
Sandstone, shaly	1		
Sandstone, massive, medium-grained, gray	15		
Concealed to bed of Dry Fork			4

In Holly District (Braxton), this sandstone is not quite so thick and does not carry so many quartz pebbles. Its dimensions and character are shown in the special sections in Chapter IV for Buckeye Creek, Palmer, and Erbacon. No quarries were observed on it.

In **Otter District,** Clay County, the Upper Freeport Sandstone forms pronounced cliffs along the north hillside of Elk River and the lower course of Big Otter Creek, and retains its conglomeratic character as exhibited in the special sections given in Chapter IV for Big Otter, O'Brien Creek, Groves—0.6 Mile Southwest, and Ivydale.

In **Buffalo District,** same county, it occurs in practically the same development as in Otter, and is a conspicuous cliff-maker along the south hillside of Elk River and on the waters of Groves and Buffalo Creeks, in the Widen region, being the great conglomerate near the ridge summits on both sides of the latter stream. Its thickness and character are shown in the sections given in Chapter IV for Groves—1 Mile Southwest (See Plate XV), Villa Nova, Groves—1.2 Miles Southeast, Harrison—¼ Mile West, Harrison—1.6 Miles East, Widen—3 Miles Northeast, Widen—1 Mile Southeast, Widen—North Edge, and Cressmont.

In **Henry District** (Clay), this sandstone retains the same conglomeratic character and development as in the two last described, its thickness and character being shown in the special sections given in Chapter IV for Barton, Valley Fork, Clay, Dundon, and Morocco. The same is also true for **Pleasant and Union Districts,** same county, as exhibited in the sections in Chapter IV for Dorfee, Morocco—2 Miles South, Head of Sycamore Creek, Wallowhole Knob—2 Miles Northeast, Wallowhole Knob, Queen Shoals, Camp, Procious, Marne, Bomont, and Birch.

THE LOWER FREEPORT COAL.

The Lower Freeport Coal, so named by the First Geological Survey of Pennsylvania from the town of Freeport in the latter State, is more or less irregular in the territory of this Report, ranging in thickness from 0 to 30 inches, and belonging 40 to 75 feet below the Upper Freeport bed and 60 to 90 feet above the Upper Kittanning seam. The area in which it appears to attain minable dimensions is confined to a narrow strip—3 to 4 miles wide—in the southeast edge of Salt Lick and Holly Districts, Braxton County, as shown on Figure 7. Its outcrop follows practically midway between that outlined on Map II for the Upper Freeport and Upper Kittanning beds. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Head of Knawl Creek, Sleith—1¾ Miles Northeast, Glendon, and Head of Mill Run, in Braxton County; and for Valley Fork—1 Mile Southwest, Wallowhole Knob—2 Miles Northeast, and Birch, in Clay. It has not been mined commercially in either county, but its thickness and character at country banks, prospect openings, and crop exposures, and its approximate minable area as limited on Figure 7, are discussed on subsequent pages in Chapter X, along with an estimate of its available tonnage.

THE LOWER FREEPORT LIMESTONE AND IRON ORE.

The Lower Freeport Limestone, belonging 5 to 10 feet below the coal last described, appears to have been entirely replaced by thin—5 to 10 inches—lenses of kidney **Iron Ore**, the latter usually being hollow with walls ½" to 1½ inches in thickness. Its stratigraphic position is shown in the sections given in Chapter IV for Gillespie—1 Mile Northwest, Palmer, and Queen Shoals. Its composition and character are discussed on subsequent pages in Chapter XI under "Iron Ore".

THE LOWER FREEPORT SANDSTONE.

The Lower Freeport Sandstone, named by Lesley and White from its occurrence at Freeport, Pennsylvania, and on the waters of the Allegheny River, where it is sometimes separated into two divisions by the Upper Kittanning Coal bed, is very persistent in Braxton and Clay, the name **Lower Freeport Sandstone** being limited in this Report to the division above the coal last mentioned. It is usually massive, medium-grained to coarse-, gray to grayish-brown in color, ranging in thickness from 30 to 60 feet, and often forming cliffs, especially in western Clay County. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV; in the logs of oil and gas wells Nos. 2, 76, 86, 87, and 93 on Map II, in Braxton, and Nos. 153, 169, 175, 189, 200, 201, 202, 214, and 242 on Map II, in Clay; and in the logs of Coal Test Borings Nos. 5, 6, and 47 on Map II. No quarries were observed on it in either county, but it is very similar in physical appearance and structure to the Upper Freeport ledge, except that it seldom carries pebbles, so that this sandstone should furnish an inexhaustible supply of material for bridge piers and abutments and masonry of similar character.

A futile attempt was once made to mine **gold** from a heading driven a few feet into this ledge in a crop exposure on the north bank of Long Run, ¼ mile southwest of Canfield, Braxton County, at an elevation of 1100′ B., the following section being measured by Gawthrop at this point:

	Feet.
Sandstone, coarse, some pebbles, Lower Freeport.........	15
Shale, siliceous, with black streaks, to bed of Long Run...	3

THE UPPER KITTANNING "RIDER" COAL.

Immediately below the stratum last described and at 0 to 25 feet above the Upper Kittanning Coal, there occurs a bony bed in Birch District, Braxton County, and Henry, Pleasant, and Union Districts, Clay, that has not been previously described. It ranges from 6 to 36 inches in thickness, is more or less bony, and appears to be a "split" off the Upper Kittanning seam proper of the Tom Hughes Fork region of Salt Lick District (Braxton), apparently representing the bony top portion of the bed in the latter locality. Hence, it is herein designated the **Upper Kittanning "Rider" Coal.** Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Glendon, Strange Creek, and

Strange Creek—1 Mile Northwest, and in the logs of Coal Test Borings Nos. 6 and 39 on Map II. It is too irregular, and impure to be classed as a minable bed as appears in the data below.

In **Birch District** (Braxton), the writer measured the following section at **Coal Exposure—No. 58 on Map II,** located in edge of road just north of the mouth of Tate Creek:

	Feet.
Sandstone, massive, grayish-white, making cliff, Lower Freeport	60
Shale, sandy	5
Coal, Upper Kittanning "Rider", (785' B.)	0.8
Shale	

At **Coal Exposure No. 59 on Map II,** 0.3 mile westward in the same road, the Upper Kittanning "Rider" is only 8 inches in thickness, at an elevation of 790' B. Both the foregoing exposures belong about 20 feet above the Upper Kittanning bed proper.

In **Henry District** (Clay), the writer obtained the following section at **Coal Exposure—No. 60 on Map II,** located on the head of the right-hand fork of Blue Knob Creek, 1¾ miles west of Clay, and 1½ miles southward from Maysel:

	Ft.	In.
Coal, Upper Kittanning "Rider", (1125' B.)	1	0
Shale and concealed	10	0
Sandstone	5	0
Shale	4	0
Coal, semi-splint, Upper Kittanning	1	6
Fire clay shale	10	0

In **Union District** (Clay), the Upper Kittanning "Rider" Coal has been prospected at three or more points. At **Coal Exposure No. 61 on Map II,** located on the **C. T. King farm,** on the west hillside of Porter Creek, 0.8 mile northeast of Odessa, Gawthrop reports this bed varying from 18 to 36 inches in thickness, at an elevation of 960' B., 17 feet above 3 feet of Upper Kittanning Coal at the C. T. King prospect.

Gawthrop reports **Coal Digging No. 62 on Map II,** in the Upper Kittanning "Rider" bed, 1.1 miles southeast of Odessa and 1.4 miles southwest of Shelton. It was closed so that its thickness could not be determined, but belongs at an elevation of about 1020' B., 3 to 5 feet above the Upper Kittanning seam.

At **Coal Exposure No. 63 on Map II,** 0.4 mile northeast of the mouth of Right Fork of Spruce and 1.1 miles southeast of Glen, Gawthrop reports the Upper Kittanning "Rider" 18 inches in thickness at an elevation of 1225′ B., 19 feet above the Upper Kittanning bed at the **Albert Durham Opening—No. 512 on Map II.**

THE UPPER KITTANNING COAL.

The Upper Kittanning Coal, named by Messrs. White, Platt, and Lesley from its occurrence near Kittanning, Pennsylvania, and belonging there just above the lower division of the Lower Freeport Sandstone, is one of the most persistent beds in the territory of this Report. It is generally multiple-bedded, carrying both gas and semi-splint types of coal, with often a peacock lustre—a feature that often causes the natives to designate it the "Peacock Seam". It ranges in thickness from 2 to 5 feet and has never been mined commercially in either county, although prospected extensively by natives for local domestic fuel. Its interval below the Upper Freeport bed ranges from 115 feet at Palmer in Braxton to 175 feet at Queen Shoals, in Clay. Its outcrop is outlined in detail on Map II, and its approximate elevation above sea-level is also shown on the same map by the **red structure contours.**

It has never been mined commercially, but its thickness, chemical composition, calorific value, and general character at country banks, prospect openings and crop exposures, and its approximate minable area as outlined on Figure 8, are described on subsequent pages in Chapter X, along with an estimate of its available tonnage.

THE UPPER EAST LYNN SANDSTONE.

In the territory of this Report, the interval separating the bed last described from the underlying Middle Kittanning Coal is occupied by a massive to current-bedded, medium-grained to coarse-, highly siliceous, grayish-white, and conglomeratic stratum, ranging in thickness from 50 to 80 feet, and forming great cliffs and steep bluffs around the hillsides in the regions of its outcrop, that corresponds to the lower division of the Lower Freeport Sandstone of the northern portion of the State as mentioned above under the description of the latter member. In order to avoid confusion of names, this ledge is herein designated the **Upper East Lynn Sandstone** in contradistinction to the East Lynn Sandstone, 0 to 15 feet lower in the measures. It is frequently almost a mass of white and ovoidal-shaped quartz pebbles—¼ to 1 inch in diameter—and its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV; in the logs of oil and gas wells Nos. 48, 74, and 89 on Map II, in Braxton County, and Nos. 111, 147, 155, 169, 173, 175, 178, 190, 192, 197, 200, 202, 214, 228, and 229 on Map II, in Clay; and in the records of Coal Test Borings Nos. 39 and 47 on Map II, in Otter and Union Districts (Clay), respectively. Its outcrop follows closely the same regions as that outlined on Map II for the Upper Kittanning Coal. Often this ledge lies unconformably upon the East Lynn Sandstone, the intervening Middle Kittanning Coal and its associated shales having been cut away entirely, a feature that added much to the difficulties in the correlation of the members of the lower half of the Allegheny Series. As with the Upper Freeport Sandstone, its great cliff exposures and general conglomeratic character make it a valuable "key-rock" in the southeastern halves of each county.

In **Salt Lick District** (Braxton), the outcrop of the Upper East Lynn is confined to the waters of the Little Kanawha River above Falls Mill, where it retains its conglomeratic and cliff-forming character, its thickness and stratigraphic position being shown in the special sections given in Chapter IV for Falls Mill, Bablin, Wildcat—North Edge, Wildcat—1 Mile Southeast, and Cleveland.

In **Otter District** (Braxton), its outcrop is confined to the southern portion on the waters of Birch and Little Birch Rivers, where it is a pronounced cliff-former, its thickness and relative position in the rock column being exhibited in the special sections published in Chapter IV for Mouth of Polemic Run, and Gravel Fork of Laurel, pages 73-4 and 74, respectively.

In **Birch District** (Braxton), its outcrop is confined to the southern portion on the waters of Birch River and Strange

Creek and the valley walls of Elk River below the town of Strange Creek, its thickness and stratigraphic position being shown in the special sections given in Chapter IV for Twistville—Diatter Run, Herold—Northeast Edge, Glendon, Strange Creek, Strange Creek—1 Mile Northwest, Jennings—½ Mile West, and Jennings—2 Miles Southeast.

In **Holly District** (Braxton), the Upper East Lynn Sandstone crops on the waters of Elk River above the mouth of Bee Run and on the waters of Little Birch River. At Palmer it has locally lost its conglomeratic nature but still retains its cliff-forming character. In the other localities mentioned, it occurs in normal development. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Sutton, Gillespie—1 Mile Northwest, Palmer, Holly—¼ Mile Southwest, Marpleton, Centralia, Erbacon, and Little Birch—1.3 Miles Southeast.

In **Otter District** (Clay), the outcrop of this sandstone is confined to the southeastern edge on the north hillside of Elk River and the immediately adjacent valley walls of the tributaries of the latter stream, where it forms great cliffs, 50 to 60 feet in height, its thickness and stratigraphic position being exhibited in the special sections given in Chapter IV for Big Otter—0.5 Mile Southeast, O'Brien Creek—Mouth of, Groves—0.6 Mile Southwest, and Ivydale.

In **Buffalo District** (Clay), the Upper East Lynn Sandstone occurs in development similar to that described for Otter, its outcrop extending throughout the entire area. Here, it proved a very valuable "key-rock" in determining the position of the Upper Kittanning Coal contours on Map II, since its conglomeratic cliffs—40 to 60 feet in height—are easily traced over wide regions. Its thickness and relative position in the rock column are shown in the special sections given in Chapter IV for Groves—1 Mile Southwest, Villa Nova—1.3 Miles South, Harrison—1.6 Miles East, Widen—1 Mile Southeast, Widen—North Edge, Cressmont, and Sand Fork—¾ Mile Northeast.

In **Henry District** (Clay), this sandstone outcrops throughout its entire area with the exception of a few square miles north of a line through Barton and Valley Fork, and retains all the features that make it prominent in both Buffalo and Otter Districts. It is this stratum and not the Homewood or "Roaring Creek" ledge that forms the great cliffs 300 and 375 feet, respectively, above Elk River at Clay and Dorfee, as erroneously correlated in former State Geological Reports. In this District, its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Valley Fork—1 Mile Southwest, Ivydale—½ Mile Southwest, Whetstone, Spread—¼ Mile Southwest, Clay, Wallowhole Knob, Sinnett Branch, Cove Hollow School—1.7 Miles East, Beech Fork of Lilly, and Morocco.

In **Pleasant and Union Districts** (Clay), the Upper East Lynn Sandstone outcrops throughout their entire area and it occurs in practically the same development as already described for other portions of Clay County, on the waters of Middle, Sycamore, and Porter Creeks, and on the south hillside of Elk River forming great conglomeratic cliffs that can be readily traced over wide areas. Its thickness and relative position in the rock column are exhibited in the special sections given in Chapter IV for Morocco—2 Miles South, Lick Branch of Adonijah, and Greendale in **Pleasant District**; and for Queen Shoals, Marne—0.7 Mile West, Birch, Bomont—1 Mile Northwest, and Bomont—1 Mile East, in **Union District.**

This stratum can be readily traced by its great conglomeratic cliff exposures along the valley walls of Elk River in Clay County from Ivydale to Clay, Dorfee, Marne, Procious, and Queen Shoals, at the latter point immediately underlying the coal bed — Upper Kittanning — that was recently mined there on a commercial scale. From Queen Shoals this sandstone is easily followed by its cliff exposures along the north hillside of Elk River by a skillful observer from a moving train on the Coal and Coke Railway to Clendenin where it passes below the bed of the latter stream.

No quarries were observed on this ledge in either county, but, in view of its highly siliceous and quartzitic nature and wide exposures in great cliffs, it should furnish an almost inexhaustible supply of clean sharp sand for concrete aggregate—when properly selected and crushed—adapted to all kinds of concrete construction work.

THE MIDDLE KITTANNING COAL.

The Middle Kittanning Coal, named by Messrs. Platt and Chance from its occurrence between the Upper and Lower Kittanning beds in western Pennsylvania, attains minable dimensions and purity in the southern portion of Birch District, Braxton, and the southeastern half of Clay County, where it is generally multiple-bedded, ranging in thickness from 2 to 8 feet, carrying both gas and splint types of coal and belonging in the interval separating the stratum last described from the underlying East Lynn Sandstone. Its outcrop follows slightly below midway between that outlined on Map II for the Upper Kittanning and No. 5 Block seams. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Cleveland, Sleith—1¾ Miles Northeast, Twistville—Diatter Run, Herold—Northeast Edge, Herold—South Edge, Glendon, Jennings—½ Mile West, Palmer, and Little Birch—1.3 Miles Southeast, in Braxton; and for O'Brien Creek, Mouth of, Groves—1.2 Miles Southeast, Harrison—1.6 Miles East, Root Fork of Groves, Plum Run, Eakle—¾ Mile Southeast, Barton, Clay, and Morocco—2 Miles South, in Clay; and in the logs of oil and gas wells Nos. 163, 175, 180, 183, 188, 227, 240, and 246 on Map II, all in Clay County. It has never been mined commercially in either county, but it has been opened by natives for local domestic fuel on Strange Creek in Birch District, Braxton, and has been prospected extensively by the large land-holding companies in Buffalo and Henry Districts, Clay County. Its thickness and character at these diggings and at crop exposures throughout the region of its occurrence and its approximate minable area, as limited on Figure 9, are described on subsequent pages in Chapter X, along with an estimate of its available tonnage.

THE EAST LYNN SANDSTONE.

The East Lynn Sandstone of Krebs[31], named from the town of East Lynn, in Wayne County, belonging there 2 to 5 feet above the No. 5 Block Coal, and occupying almost the entire interval separating the latter bed from the Upper Kittanning (North Coalburg?) seam, is widely persistent in the territory of this Report. Herein it is limited to the ledge lying between the coal last described and the undoubted No. 5 Block seam in the belief that the stratum as originally described by Krebs is separated into two members in Braxton and Clay—**Upper East Lynn** and **East Lynn**—by the Middle Kittanning Coal. This is the only tenable conclusion on the basis that the No. 5 Block Coal of the Montgomery region of Fayette County represents the Lower Kittanning bed of the northern portion of the State. The East Lynn Sandstone, as thus limited in the two counties, is massive to current-bedded, medium-grained, seldom pebbly, highly siliceous, grayish-white in color, ranging in thickness from 25 to 70 feet, and forming great cliffs and steep bluffs around the hillsides in the regions of its outcrop, especially in Clay County. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV; and in the logs of oil and gas wells Nos. 123, 168, 169, 173, 175, 190, 192, 197, 200, 202, and 228A on Map II. Since it belongs immediately above the No. 5 Block Coal, its outcrop follows closely the same regions as that outlined for the latter bed on Map II.

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[31] C. E. Krebs, Cabell-Wayne-Lincoln Report, W. Va. Geol. Survey, pp. 183-4; 1913.

In **Salt Lick District (Braxton)**, the outcrop of the East Lynn Sandstone is confined to the southeast portion on the waters of Falls Creek and the Little Kanawha River above Falls Mill, its thickness and stratigraphic position in this region being shown in the special sections given in Chapter IV for Head of Knawl Creek, Falls Mill, Wildcat—North Edge, Wildcat—1 Mile Southeast, and Cleveland.

In **Otter District** (Braxton), the outcrop of this sandstone is confined to the waters of Birch River above Herold, where it forms grayish-white cliffs 40 to 50 feet in height, its thickness and relative position in the rock column being exhibited in the special sections given in Chapter IV for Mouth of Polemic Run and Head of Mill Creek, pages 73-4 and 89, respectively.

In **Birch District** (Braxton), the outcrop of the East Lynn Sandstone is limited to the southern corner on the waters of Birch River above the road crossing of the latter, 0.7 mile southwest of the mouth of Diatter Run; and on Strange Creek.

above the mouth of Frame Run, its thickness and stratigraphic position in this locality being shown in the special sections given in Chapter IV for Twistville—Diatter Run, Herold—Northeast Edge, Herold—South Edge, Glendon, and Jennings—2 Miles Southeast, a study of which reveals its more or less lenticular nature as Elk River is approached from the southeast.

In **Holly District** (Braxton), this sandstone outcrops on the waters of Elk River above the mouth of Stony Creek; on Wolf Creek above the mouth of Bee Hollow; and on Little Birch River above Little Birch P. O., possessing here the same lenticular character as in Birch District as shown in the special sections given in Chapter IV for Sutton, Gillespie—1 Mile Northwest, Palmer, Centralia, and Erbacon, and exhibiting its usual lack of pebbles along with its medium-grained structure and grayish-white color.

In **Otter District (Clay)**, the outcrop of the East Lynn Sandstone is confined to the north hillside of Elk River and the immediately adjacent valley walls of the larger tributaries of the latter stream, where it forms great cliffs, 40 to 60 feet in height, its thickness and stratigraphic position here being shown in the special sections given in Chapter IV for Mouth of O'Brien Creek, Groves—0.6 Mile Southwest, and Ivydale. It possesses here the same highly siliceous nature and grayish-white color, with very few pebbles, as in the other Districts described.

In **Buffalo District** (Clay), this sandstone is a conspicuous cliff-former along the south hillside of Elk River, and on the waters of Groves and Buffalo Creeks, some of which are 50 to 70 feet in height, its general physical appearance being practically the same as in the Districts above described, as shown in the special sections given in Chapter IV for Groves—1 Mile Southwest, Villa Nova—1.3 Miles South, Groves—1.2 Miles Southeast, Widen—3 Miles Northeast, and Cressmont. Here the Upper East Lynn frequently rests directly upon it, resulting in the disappearance of the Middle Kittanning Coal and its associated roof and bottom shales.

In **Henry District** (Clay), the East Lynn Sandstone does not pass below drainage of the larger streams, except in the northern corner, and it attains practically the same development as in Buffalo District. Along the valley walls of Elk River, it often forms cliffs in conjunction with the conglomeratic Upper East Lynn ledge 150 or more feet in height, a feature that explains the frequent **absence of the Middle Kittanning Coal** along this stream between Ivydale and Queen Shoals. In this District, the thickness and stratigraphic position of the East Lynn are exhibited in the special sections given in Chapter IV for Barton—1.5 Miles Southeast, Clay, Cove Hollow School—1.7 Miles East, Beech Fork of Lilly, and Morocco.

In **Pleasant District** (Clay), this sandstone outcrops on all the larger streams in practically the same development as in Henry and Buffalo, its thickness and stratigraphic position being shown in the special sections given in Chapter IV for Morocco—2 Miles South, Head of Sycamore Creek, and Lick Branch of Adonijah. It is this stratum that forms the cliffs and steep slopes 75 to 90 feet in height immediately below the prospect openings in the Middle Kittanning Coal on the waters of Middle Creek.

In **Union District** (Clay), it forms prominent escarpments along the valley walls of Elk River, Porter Creek, and Blue Creek, its cliff exposures here showing the same lack of pebbles along with practically the same development as in the areas previously described. Its thickness and relative position in the measures are exhibited in the special sections given in Chapter IV for Queen Shoals, Birch, and Bomont—1 Mile East, the latter showing the maximum development reported in either county. This, however, is made up from the log of an oil well—No. 169 on Map II—and for that reason is not so reliable as observations at outcrop exposures, since drillers often fail to record thin coal and slates in a general sandstone mass.

No **quarries** were observed on this ledge in either county, but, owing to its highly siliceous nature and wide exposure in easily accessible cliffs, it should furnish an inexhaustible and convenient supply of material suitable for concrete aggregate in all forms of construction work. Its undoubted durable qualities should recommend it for building purposes, but its more or less current-bedded structure prevents its splitting readily into blocks of any desired size, and for that reason it is better adapted to rough stone work.

THE NO. 5 BLOCK (LOWER KITTANNING) COAL.

The No. 5 Block Coal of White[32], belonging at its type locality—Montgomery and Crescent, Fayette County—60 to 70 feet above the Kanawha Black Flint—is very persistent in the territory of this Report where it has been tentatively correlated with the Lower Kittanning Coal, the latter having been so designated by Lesley of the First Geological Survey of Pennsylvania from its occurrence near Kittanning in the last-mentioned State. The former is generally multiple-bedded, carrying both gas and splint types of coal, with the latter predominating. Coming from the mines in both large and small blocks and standing shipment well, it has acquired an excellent reputation as a general steam and domestic fuel. The name "**No. 5 Block**" is given precedence herein, since the position of the latter south of Elk River in Braxton and Clay, with the possible exception of Holly District, is fixed by its interval—ranging from 70 to 100 feet—above the Kanawha Black Flint, while there is a possibility that the seam which has been described on a preceding page of this Chapter as the **Middle Kittanning** may prove to be the true Lower Kittanning Coal. Should this happen, then the No. 5 Block bed should correlate with either the Clarion of the Allegheny Series or possibly the Upper Mercer of the Pottsville of western Pennsylvania. The more or less lenticular nature of the Upper East Lynn and East Lynn Sandstones, resulting in rapidly varying intervals between the associated coals in the forested region of southern Braxton, makes it a very difficult matter to trace the Lower Kittanning Coal with certainty—in the limited time assigned for the work—southwestward from the points where the Bablin, Palmer, and Centralia Sections, given in Chapter IV, were determined, to where the true No. 5 Block bed rises above drainage on Birch River and Strange Creek. Before all doubt is removed, the detailed geology of Webster, Nicholas, and

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[32] I. C. White, Vol. II(A), W. Va. Geol. Survey, pp. 525-528; 1908.

Fayette Counties will probably have to be completed. In Chapter IV, the name Lower Kittanning Coal appears in the sections for Salt Lick and Holly Districts, but in other Districts the name "No. 5 Block" is given preference.

As shown in the Upper Kittanning Coal table of intervals given in Chapter III, as also the sections for the same localities published in Chapter IV, the Lower Kittanning Coal ranges from 155 to 180 feet above the Kanawha Black Flint at Bablin, Palmer, Centralia, and Marpleton, results agreeing closely with that obtained in southern Clay above the same datum for the bed described on preceding pages of this Chapter as the Middle Kittanning and as also found for the **"North Coalburg"** seam in the Kanawha Valley. Both the latter are immediately overlain with a very pebbly sandstone in the localities mentioned, while pebbles seldom occur in the heavy ledge immediately overlying the No. 5 Block bed in southern Clay. These items are mentioned to show that in spite of other apparent stratigraphic evidence to the contrary that the coal designated herein as the Middle Kittanning in southwestern Braxton and southern Clay, as also the North Coalburg, may prove to be the true Lower Kittanning seam.

The investigations of the writer in the field during 1915 demonstrated conclusively that the coal once mined commercially at Queen Shoals is the **Upper Kittanning bed** and not the No. 5 Block as correlated by White[33] and Krebs[34] in former Reports of the State Geological Survey.

The outcrop of the No. 5 Block Coal is outlined in detail on Map II. It is mined commercially on an extensive scale at Widen, Clay County, and it has been opened at many points by natives for local domestic fuel and prospected extensively by the large land-holding companies. Its thickness and character at these mines and diggings, as also crop exposures, and its approximate minable area as limited on Figure 10, are described on subsequent pages in Chapter X, along with an estimate of its available tonnage.

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[33] I. C. White, Vol. II(A), pp. 530-1; 1908.

[34] C. E. Krebs, Kanawha County Report, pp. 439-440; 1914.

THE KITTANNING SANDSTONE.

The Kittanning Sandstone of western Pennsylvania, belonging there, according to I. C. White[35], in the interval separating the Lower Kittanning Coal from the Ferriferous Limestone and above the Clarion Coal, occurs in the territory of this Report, but is more or less lenticular and was definitely recognized at only one or two points. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Mill Creek and Rosedale, pages 75 and 76-7, respectively. In previous Reports of the Survey, this stratum has been erroneously correlated with the **Clarion Sandstone** of Chance[36], but the latter belongs directly below the Clarion Coal at its type locality near Clarion, Pennsylvania, as shown in the reference cited.

THE CLARION COAL.

The Clarion Coal, originally designated by the First Geological Survey of Pennsylvania from the town of Clarion in the latter State, is fairly persistent and appears to attain minable dimensions, being multiple-bedded, carrying both gas and splint types of coal and ranging in thickness from 15 inches to 3 or more feet. Its stratigraphic position is shown in the special sections given in Chapter IV for Mill Creek, Gillespie—1 Mile Northwest, Erbacon—Northwest of, and Cove Hollow School—2 Miles South; in the logs of oil and gas wells Nos. 78, 79, and 86 on Map II; and in the records of coal test borings Nos. 43 and 48 on Map II. Its outcrop follows closely the same regions as that outlined on Map II for the No. 5 Block (Lower Kittanning) bed, since it belongs only 15 to 40 feet below the latter. It has never been mined commercially in the area, but it has been prospected considerably by natives in each county for local domestic fuel. Its thickness and character at these diggings, and its approximate minable area, as limited on Figure 11, are described on subsequent pages in Chapter X, along with an estimate of its available tonnage.

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[35] Bull. No. 65, U. S. Geol. Survey, p. 172; 1891.

[36] H. M. Chance, Report VV—Clarion County, Second Geol. Survey of Pennsylvania, pp. 143-7.

Under the description of the No. 5 Block Coal on a preceding page of this Chapter, the possibility of the latter's being the Clarion is mentioned, which, if true, would then place the bed described herein under the latter name at probably the **Brookville** horizon.

CHAPTER VIII.

STRATIGRAPHY—POTTSVILLE SERIES.

(KANAWHA GROUP.)

GENERAL ACCOUNT.

The Pottsville Series in West Virginia attains its maximum development in the extreme southern portion of the State in Wyoming and McDowell Counties, reaching a total thickness of 3850 feet as shown by the writer[1] in a special detailed section, where all three divisions are represented; viz, Kanawha, New River, and Pocahontas. In the territory of this Report, the series has thinned down to about one-third the figure last given and only the **Kanawha Group** of White[2] is represented in the surface rocks, the basal portion of the Pottsville lying below drainage. The latter group begins at top with the Homewood Sandstone and extends down to the top of the great Nuttall Sandstone of the New River Group in the Kanawha Valley. It probably does not much exceed 850 to 900 feet as compared to about 1200 feet in the latter region and about 1900 feet along the southern edge of McDowell County. Its strata consist of sandstones, massive, medium- to coarse-grained, gray to grayish-brown or dove-colored, the latter prevailing in the lower half; coal beds, generally hard and carrying both gas and splint coal in the upper two-thirds of the group, and the soft columnar type in the lower third; impure fire clays; shales, both argillaceous and arenaceous, buff, gray, and black in color; and several thin, lenticular, and impure limestones, some of which carry a marine fossil fauna. Sandstone constitutes by far the greater bulk of strata but the contained coal beds have much the greater economic value from a mineral standpoint, the formation holding 6 minable seams, in addition to about one dozen others of doubtful value.

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[1] Ray V. Hennen, Wyoming-McDowell Report, pp. 50-60; 1916.
[2] I. C. White, Vol. II, W. Va. Geol. Survey, pp. 500-502; 1903.

The Kanawha Group affects the topography in much the same way as at its type locality in Kanawha and Fayette Counties, in that the valley walls along the drainage channels are high, steep, and rugged, broken frequently by narrow flat benches marking the deposits of shale and coal that separate the heavy sandstone ledges.

The following general section, compiled from those published in Chapter IV and a large number of other detailed observations, is fairly representative of the Kanawha Group in Braxton and Clay. The basal portion of the Pottsville is also included, the only information on the stratigraphy of the latter being the logs of the oil and gas well borings:

General Section of the Pottsville Measures in Braxton and Clay Counties.

	Thickness. Feet.	Total. Feet.	
Kanawha Group (855')			
Sandstone, Homewood, "Roaring Creek", massive to current-bedded, medium-grained to coarse- and pebbly, grayish-white, forms cliffs	50 to 100	100	
Coal, Stockton "A", multiple-bedded, splinty	0 to 2	102	102'
Shale, sandy, and flaggy, sandstone, lenticular	0 to 33	135	
Flint, Kanawha Black, bluish-black, ranging from hard siliceous slate to hard quartz and carrying a marine fossil fauna	0 to 5	140	
Coal, Stockton, "Lewiston", multiple-bedded, hard, splinty, with softer gas layers	0 to 5	145	43'
Shale, gray	4 to 12	157	
Sandstone, Upper Coalburg, massive to current-bedded, medium-grained, gray to grayish-white, lenticular, very irregular in thickness	0 to 75	232	
Coal, Coalburg, "Dundon", "Dorfee", multiple-bedded, hard, splinty, with softer gas layers, mined commercially at Pisgah (Clay County), and formerly at both Dundon and Dorfee	0 to 8	240	95'
Shale, sandy, lenticular	0 to 12	252	

	Thickness. Feet.	Total. Feet.	
Coal, Little Coalburg, double-bedded, bony, lenticular	0 to 3	255	15′
Sandstone, Lower Coalburg, massive to current-bedded, medium-grained, grayish-white, lenticular	20 to 25	280	
Sandstone, Upper Winifrede, massive to current-bedded, grayish-white and brown	20 to 33	313	
Coal, Winifrede, multiple-bedded, splinty	0 to 2	315	60′
Sandstone, Lower Winifrede	30 to 50	365	
Limestone, Winifrede, yellowish-gray, lenticular, **marine fossiliferous,** often replaced with dark shales carrying **marine fossils** in abundance	0 to 5	370	
Coal, Chilton, multiple-bedded, medium-hard, gas type	0 to 4	374	59′
Sandstone, Hernshaw	25 to 30	404	
Coal, Hernshaw, gas, medium-hard	0 to 1	405	31′
Shale and sandstone	15 to 20	425	
Coal, Holly (Williamson?), slaty cannel at top, gas coal in bottom, slaty cannel mostly	0 to 5	430	25′
Sandstone, Upper Cedar Grove, medium-grained, gray	30 to 45	475	
Shale	0 to 5	480	
Coal, Marpleton (Cedar Grove?), multiple-bedded	0 to 3	483	53′
Shale and sandstone, alternating	30 to 40	523	
Sandstone, Peerless, massive, medium-grained, gray	20 to 27	550	
Shale, dark, with **Lingulae fossils** and lenses of **Campbell Creek Limestone.**	10 to 15	565	
Coal, Campbell Creek, "Peerless" and "No. 2 Gas", multiple-bedded, medium-soft	0 to 5	570	87′
Sandstone, Brownstown, fine- to medium-grained, gray	30 to 58	628	
Coal, Powellton	0 to 2	630	60′
Shale, sandy	30 to 45	675	
Sandstone, Eagle, medium-grained, gray	30 to 40	715	
Shale, dark, sandy	5 to 11	726	
Coal, Eagle, multiple-bedded, medium-soft	0 to 4	730	100′
Sandstone, Decota, often replaced by sandy shale	20 to 33	763	
Coal, Little Eagle, multiple-bedded	0 to 2	765	35′
Shale, sandy	20 to 25	790	
Shale, Eagle, black, sandy, Lingulae fossils, and lenses of **Eagle Limestone**	10 to 15	805	
Shale and sandstone, alternating	40 to 50	855	90′
New River Group (425′)			
Sandstone, Nuttall, grayish-white, pebbly, forms cliffs along Elk southeast of Centralia	60 to 85	940	
Coal, Lower Douglas, "Hughes Ferry"	0 to 5	945	90′
Shale and sandstone	50 to 80	1025	
Coal, Sewell?, multiple-bedded, soft	0 to 5	1030	85′

	Thickness. Feet.	Total. Feet.	
Shale and sandstone	40 to 50	1080	
Coal, Welch?	0 to 5	1085	55'
Shale and sandstone	25 to 35	1120	
Sandstone, Upper and Lower Raleigh	50 to 100	1220	
Shale and sandstone	40 to 60	1280	195'
Mauch Chunk Series			
Shale, red			

DESCRIPTION OF MEMBERS, KANAWHA GROUP.

THE HOMEWOOD (ROARING CREEK) SANDSTONE.

The Homewood Sandstone of the Second Geological Survey of Pennsylvania, or the "Roaring Creek" of I. C. White[3], the youngest and highest member of the Kanawha Group, attains a fine development in the territory of this Report, ranging from 50 to 100 feet in thickness. It is generally massive to current-bedded, medium-grained to coarse-, sometimes pebbly, grayish-white in color, and forms cliffs and steep slopes along its outcrop, the latter being confined to practically the same regions as that outlined on Map II for the No. 5 Block (Lower Kittanning) Coal. Its thickness, character, and relative position in the measures are exhibited in many of the special sections given in Chapter IV; in the logs of oil and gas wells Nos. 2, 34, 48, 69, 70, 72, 74, 76, 78, 85, 86, 89, 95, 100, 108, 118, 169, 173, and 175 on Map II; and in the records of coal test borings Nos. 6 and 33 on Map II. It follows, of course, that should the No. 5 Block Coal prove to be the Upper Mercer bed, a remote possibility suggested under the description of the former on a preceding page of this Chapter, then this ledge as limited in the southern border of Braxton and the southeastern half of Clay should represent the Upper Connoquenessing. No quarries were observed on it in either county, but it is very similar in physical appearance and texture to the East Lynn Sandstone and should be adapted to practically the same uses, its wide exposures in great cliffs furnishing an inexhaustible supply of easily accessible stone.

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[3] Vol. II(A), W. Va. Geol. Survey, pp. 488-9; 1908.

THE STOCKTON "A" COAL.

Immediately at the base of the sandstone last described, 10 to 30 feet above the Kanawha Black Flint and 20 to 40 feet above the Stockton Coal, there occurs a bed that has not been previously described. It is herein named the **Stockton "A" Coal** from its association close above the Stockton seam. It is generally multiple-bedded, splinty, and more or less bony and irregular, seldom exceeding 2 feet in thickness, and for that reason has not been classed as a minable coal. Its thickness and relative position in the measures are exhibited in the special sections given in Chapter IV for Wildcat—North Edge, Cleveland, Groves—1 Mile Southwest, Ivydale, Whetstone, Spread, Clay, Laurel Fork of Lilly, Morocco, Cove Hollow School—2 Miles South, Lick Branch of Adonijah, and Birch; and in the log of Coal Test Boring No. 6 on Map II.

In the northeast edge of **Henry District** (Clay), it appears to be this bed that crops in the Coal and Coke Railway cut, just below the mouth of Turkey Run, 0.1 mile southwest of Swandale, where the following section was measured by Gawthrop:

Coal Exposure—No. 64 on Map II.

				Ft.	In.
Sandstone, visible, Homewood				15	0
Coal, gas	0'	3"	Stockton "A" (750' B.)...	2	6
Fire clay shale	1	3			
Coal	0	4			
Slate	0	6			
Coal	0	2			
Fire clay shale and concealed to Coal and Coke Railway grade					

In **Pleasant District** (Clay), the writer measured the following section at **Coal Exposure No. 65 on Map II,** of this bed on the east bank of Right Fork at Lizemores:

				Ft.	In.
Sandstone, massive				12	0
Coal, Stockton "A", splinty (1004.5' L.)				2	0
Shale, flaggy and gray				8	0
Flint, Kanawha Black (995' L.)				1	6
Coal, gas	0'	11"	Stockton	16	3
Shale, gray, sandy	14	0			
Coal, splint	1	4			
Fire clay shale				4	0

In the same District, the writer measured the following section at **Coal Prospect No. 66 on Map II,** located on the east edge of road on Middle Creek, 0.9 mile north of Rosetta

	Ft.	In.
Concealed by debris	..	..
Coal, splinty, Stockton "A", (1055' B.)	1	0
Sandstone, partly concealed	10	0
Interval to Kanawha Black Flint, 20' to	25	0

In **Union District,** the writer examined the following prospect, located on the point just east of the mouth of Camp Run at Camp Station on the Coal and Coke Railway:

Coal Prospect—No. 67 on Map II.

				Ft.	In.
Sandstone, platy, making great cliff, Homewood				40	0
Coal, splint	0'	6"			
Shale, dark-gray	0	9	Stockton "A"		
Coal, splint	0	8	(730' B.)	1	11
Slate, gray					

Two miles southwestward in the same District, Gawthrop measured the following section at **Coal Exposure No. 68 on Map II,** located on the west bank of Porter Creek, 1.5 miles northwest of Bomont:

				Feet.
Sandstone, visible, Homewood				10
Shale, siliceous				1
Coal, slaty	0'	3"	Stockton "A"	2
Coal, hard	1	9	(720' B.)	
Sandstone to bed of creek				3
Interval to Kanawha Black Flint estimated by Gawthrop				15

One-tenth mile northwestward in the same District (Union), Gawthrop measured the following section at **Coal Exposure No. 69 on Map II:**

	Ft.	In.
Concealed from Upper Kittanning Coal bench	190	0
Sandstone, massive, gray and hard, Homewood	55	0
Coal, Stockton "A", (725' B.)	0	7
Concealed, sandstone, and concealed	15	0
Kanawha Black Flint, somewhat shaly, black, carrying marine fossils of the genus Orbiculoidea	5	0

In the southern portion of the same District, Gawthrop measured the following section at **Coal Exposure No. 70 on**

Map II, located on the south bank of Spruce Fork of Blue Creek, 2 miles west of Spruce Low Gap:

	Ft.	In.
Sandstone, visible, Homewood	5	0
Coal, Stockton "A" (910' B.)	0	3
Shale and concealed		

It is quite evident from the foregoing data that the Stockton "A" Coal is too thin and irregular to be classed as minable.

THE KANAWHA BLACK FLINT.

The Kanawha Black Flint of Rogers[4] and White[5] occurs in typical form in southern Clay. In other portions of the latter County and in southern Braxton, it is frequently represented by a dark, flaggy, micaceous shale, carrying marine fossils similar in type to those found in the same ledge at Queen Shoals, as published on Plates I and II opposite page 654 of the Kanawha County Report of the State Geological Survey. Its thickness, character, and stratigraphic position are exhibited in the special sections given in Chapter IV for Bablin, Cleveland, Palmer, and Centralia, in Braxton; for Clay, Beech Fork of Lilly, Dorfee, Head of Sycamore Creek, Greendale, Queen Shoals, and Marne—North Edge; and in the logs of oil and gas wells Nos. 115, 194, 205, and 208 on Map II. This member proved an invaluable "key-rock" in determining the position of the Stockton Coal and the top of the Kanawha Group in the area in question, a feature that aided very materially in joining the Pottsville of the northern counties with the series as represented southwestward to Tug River at the Kentucky State Line and Pocahontas at the Virginia Line. Since it belongs only 100 to 140 feet below the top of the Kanawha Group, its outcrop follows roughly the same regions as that outlined on Map II for the division line between the latter group and the Allegheny Series.

In **Holly District** (Braxton), the Kanawha Black Flint is represented by sandy and flaggy shale, with marine fossils, directly above the Stockton Coal, a fine exposure of which, examined by the writer, occurs at an opening in the latter bed on the north bank of a branch of Laurel Creek, ½ mile southwest of Centralia, at an elevation of 1405′ B., as shown in the section given in Chapter IV for the latter point, pages 101-3.

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[4] W. B. Rogers, Fifth Annual Geological Report of Virginia; 1839.

[5] I. C. White, Bull. 65, U. S. Geol. Survey, p. 98; 1891; and Vol. II, W. Va. Geol. Survey, pp. 328-331; 1903.

In **Henry District** (Clay), the Flint horizon is represented by marine fossiliferous shale at its crop exposures in the roof of the Stockton Coal at an opening in the latter seam on the north side of Elk River, 0.3 mile northwest of Dundon, at an elevation of 735′ B., about 50 feet above another opening in the Coalburg Coal on the same side of Elk. Its stratigraphic position here is exhibited in the section given in Chapter IV for Clay, page 129. Marine fossils were found in the same horizon or roof shales of the Stockton Coal by C. L. Voglesang at a prospect opening on the west bank of Pisgah Run, 0.3 mile up the latter and slightly less than a mile southward from the Coal and Coke Railway Station at Clay, at an elevation of 820′ B.

In the southern point of the same District, this formation attains its normal development of the Kanawha Valley region, being more or less cherty, carrying marine fossils and having a thickness of 4 to 6 feet at exposures on Leatherwood Creek and on waters of Lilly Fork. Its stratigraphic position in this locality is shown in the Beech Fork of Lilly Section, page 139.

In the northern edge of **Pleasant District** (Clay), there occurs a fine exposure of the Flint on the south hillside of Elk River, 0.5 mile northeast of the Coal and Coke Railway station at Dorfee, its thickness and stratigraphic position here, as determined by Gawthrop and the writer, being shown in the section given in Chapter IV for Dorfee, page 146. Southward in the same District, several exposures of this formation occur along Middle Fork Creek and on Right Fork of Leatherwood, many of which will be given in connection with the description of the Stockton Coal in Chapter X. Here, its physical structure grades about midway between chert and siliceous shale.

In the southeastern edge of Pleasant District, it occurs in its typical cherty form on the head of Sycamore Creek and on Rockcamp and Open Forks of Bells Creek, its thickness and

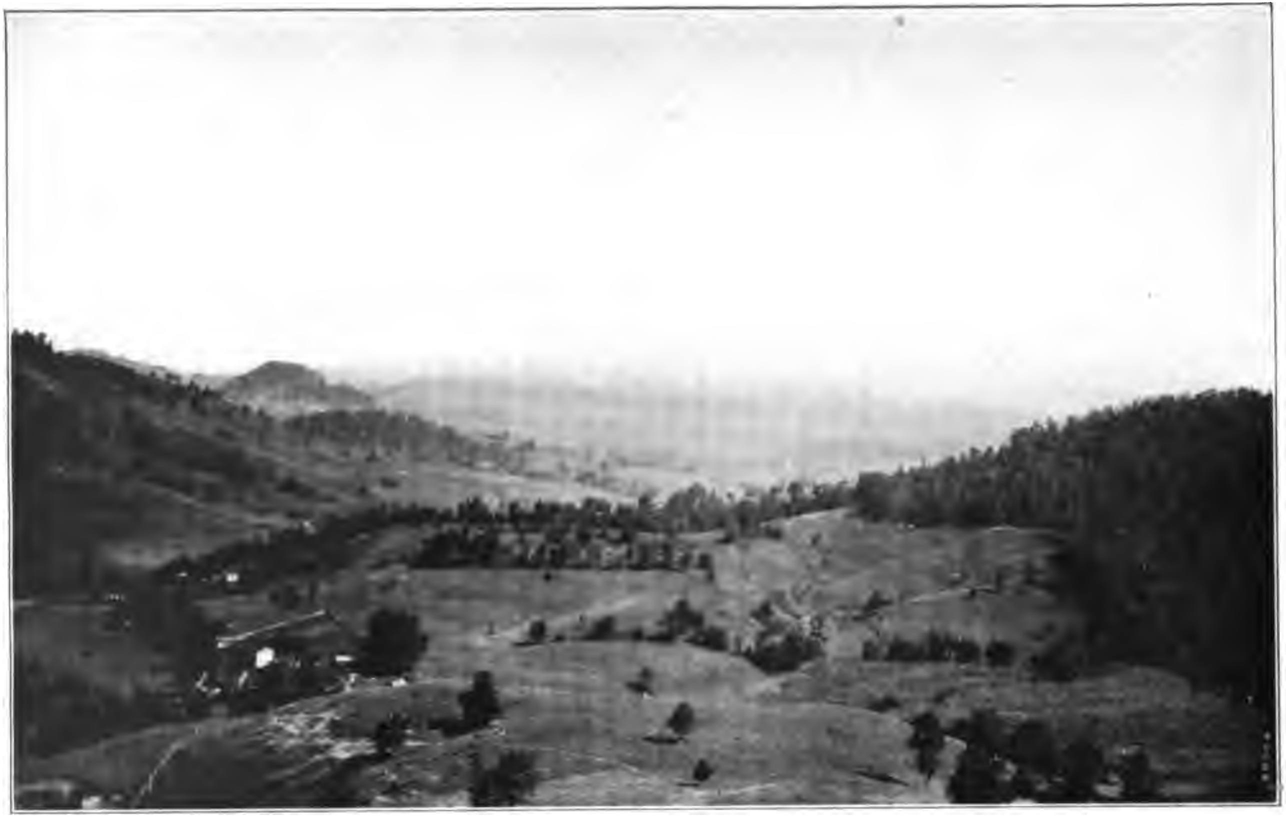

PLATE X.—Looking N. 25° W. from head of Left Fork of Saltlick, showing topography of Monongahela and Conemaugh Series.

relative position here being shown in the sections given in Chapter IV for Head of Sycamore Creek and Greendale.

In **Union District (Clay)**, the Flint occurs in typical development in crop exposures in the lower course of Porter Creek and on Queen Shoals Creek. Its thickness and stratigraphic position are exhibited in the Queen Shoals, and Marne—North Edge, Sections, pages 154 and 159, respectively.

THE STOCKTON COAL.

The Stockton Coal of White[6], belonging at its type locality—Cannelton, Kanawha County—immediately below the member last described and so named from Aaron Stockton, who once mined it at the latter point, is very persistent in both Braxton and Clay, where it attains sufficient importance to be classed as a minable seam. It is always multiple-bedded and carries both gas and splint types of coal, the former predominating in the upper portion of the bed. Its thickness and stratigraphic position are exhibited in many of the special sections given in Chapter IV, as also in the logs of oil and gas well borings. It has not been mined commercially in either county, but it has been prospected quite extensively by natives for local domestic fuel and by the large land-holding companies. Its character at these diggings as well as in the sections and borings last mentioned is described on subsequent pages in Chapter X, along with a discussion of its approximate minable area as limited on Figure 12.

It appears probable that the **Stockton** correlates with the **Upper Mercer Coal** of western Pennsylvania, unless the No. 5 Block bed should prove to be the latter seam, in which event the Stockton might represent the **Quakertown.**

THE COALBURG SANDSTONE.

The Coalburg Sandstone of White[7] or the Upper Coalburg Sandstone of the writer and Reger[8], belonging in the interval separating the coal last described from the underlying Coalburg bed, is irregular and lenticular in its occurrence in both counties, ranging in thickness from 0 to 40 feet. It is generally massive to current-bedded, medium-grained, micaceous, and gray in color, and is noted in the special sections given in Chapter IV for Widen—3 Miles Northeast, Valley Fork—1 Mile Southwest, Clay, Schoonover Knob, and Birch. The lenticular character of this stratum accounts for the extreme fluctuations of the interval separating the Stockton and Coalburg Coal seams in Clay County. Along the Coal and Coke Railway grade at Dundon, just north of the station, this ledge may be seen cutting out the latter coal entirely, forming here a pronounced cliff. No quarries were observed on it in either county.

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[6] I. C. White, Vol. II, W. Va. Geol. Survey, p. 538; 1903.

[7] I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 468; 1908.

[8] Ray V. Hennen and D. B. Reger, Logan-Mingo Report, W. Va. Geol. Survey, pp. 137-8; 1914.

THE COALBURG COAL.

The Coalburg Coal of White[9], belonging at its type locality—Coalburg, Kanawha County—60 to 100 feet below the Kanawha Black Flint, attains minable dimensions and purity in the territory of this Report. It is generally multiple-bedded, and, like the Stockton, carries both gas and splint types of coal, the latter predominating. It is this bed and not the Winifrede, as tentatively correlated in former State Reports, that was once mined commercially at Dundon and Dorfee, Clay County, and is now being operated on Pisgah Run, ¾ mile due south of Clay. The special sections given in Chapter IV for Clay and Dorfee, pages 129 and 146, respectively, corroborate this statement. This bed has also been prospected quite extensively by natives for domestic fuel on Buffalo, Leatherwood, Middle, and Sycamore Creeks in southeastern Clay County, and it is frequently separated from the overlying Stockton seam by less than 5 feet of shale, the same interval expanding at other times to 80 or 90 feet in the southern point of Pleasant District (Clay). Its thickness and character at the commercial mines, prospect openings, and crop exposures, and its approximate minable area, as limited on Figure 13, are discussed on subsequent pages in Chapter X. Its detailed outcrop is outlined by appropriate symbol on Map II.

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[9] I. C. White, Bull. 65, U. S. Geol. Survey, p. 162; 1891; and Vol. II, W. Va. Geol. Survey, pp. 548-556; 1903.

THE LITTLE COALBURG COAL.

The Little Coalburg Coal of Reger and the writer[10], originally described as a split off the Coalburg bed proper, appears to be represented in Clay County where it is usually a hard, bony splint coal, belonging from less than 6 inches to 15 feet below the Coalburg and ranging in thickness from 1 to 3 feet. At the Pisgah Mine of the Elliott Splint Coal Co., ¾ mile south of Clay, it is 15 to 18 inches in thickness, bony, and only 5 inches beneath the Coalburg. About 5 miles southward on a west side branch of Right Fork of Leatherwood, ¼ mile southwest of the mouth of Bullpen Fork, the writer observed 45 inches of bony splint coal, with 6 inches of sandstone 13 inches above the pavement, at this horizon, the whole belonging 12 feet below a prospect opening in the Coalburg bed, 23 feet below another in the Stockton seam, and 28 feet below the Kanawha Black Flint. In the area in question, the Little Coalburg is too impure and irregular to be classed as a minable seam.

THE LOWER COALBURG SANDSTONE.

The Lower Coalburg Sandstone of Reger and the writer[11], belonging immediately below the coal last described, is very persistent in Braxton and Clay, where it is generally massive to current-bedded, medium-grained, micaceous, gray to grayish-white in color, ranging in thickness from 20 to 30 feet and sometimes coalescing with the underlying Upper Winifrede into a single great ledge. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Cressmont, Clay, Dundon, Sandfork—0.7 Mile Southwest, Cove Hollow School--1.7 Miles East, Cove Hollow School—2 Miles Southwest, and Camp. This stratum forms steep cliffs and bluffs along the valley walls of Elk River between Dundon and Shelton, and southeastward from Dundon along Buffalo Creek. No quarries were observed on this ledge in either county, but its wide cliff exposures, in conjunction with the Lower Winifrede, should furnish an inexhaustible supply of stone adapted for foundations and rough work, as also a fair aggregate for concrete, due to its siliceous nature.

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[10] Ray V. Hennen and D. B. Reger, Logan-Mingo Report, W. Va. Geol. Survey, pp. 140-1; 1914.

[11] Ray V. Hennen and D. B. Reger, Logan-Mingo Report, p. 141; 1914.

THE UPPER WINIFREDE SANDSTONE.

The Upper Winifrede Sandstone of White[12], belonging at its type locality in Kanawha County directly above the Winifrede Coal, attains practically the same development in Braxton and Clay as the ledge last described and with which, as mentioned above, it often coalesces into a single ledge. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Widen—3 Miles Northeast, Cressmont, and Schoonover Knob; and in the log of Coal Test Boring No. 33 on Map II, on the head of Right Fork, 4 miles southeast of Strange Creek. One mile eastward from Dundon on the north side of Buffalo, Gawthrop obtained the following data at a quarry in this ledge:

Elk River Coal and Lumber Co. Quarry.

		Feet.
Sandstone, partly concealed, from Coalburg Coal bench..		60
Sandstone, flaggy to massive....................	10'	
Sandstone, massive, broken, fine-grained, medium-hard, grayish-brown, micaceous..............	15	
Sandstone, massive, fine-grained, micaceous, hard, gray	25	50
Coal, Winifrede, (3").................................		0.3

On November 3, 1915, this quarry was furnishing employment for 12 to 15 men, the stone from it being crushed and used for ballast on the Buffalo Creek and Gauley Railway, the capacity of the plant being from 70 to 80 cubic yards daily. This is the only operation observed on the ledge in either county.

THE WINIFREDE COAL.

The Winifrede Coal of White[13], belonging at its type locality in Kanawha County 175 to 200 feet below the Kanawha Black Flint and 70 to 100 feet below the Coalburg bed, is fairly persistent in the territory of this Report, attaining minable dimensions and purity in southern Clay County, where it is generally multiple-bedded and splinty, seldom exceeding 3 feet in thickness. Its stratigraphic position is shown in the special sections published in Chapter IV for Holly—1.3 Miles Southwest, in Braxton; and for Widen—3 Miles Northeast, Wallback, Clay, and Greendale, in Clay County; in the logs of oil and gas wells Nos. 114, 127, 128, 151A, 156, 179, 188, 202, 206, 210, and 230 on Map II; and in the record of coal test boring No. 33 on Map II. It has never been mined commercially in either county, but it has been prospected considerably by natives for local domestic fuel. Its thickness and character at these diggings and at other crop exposures, and its approximate minable area as limited on Figure 14, are described on subsequent pages in Chapter X, along with an estimate of its available tonnage.

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[12] I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 271; 1908.

[13] I. C. White, Bull. 65, U. S. Geol. Survey, p. 162; 1891; and Vol. II, W. Va. Geol. Survey, p. 556; 1903.

THE LOWER WINIFREDE SANDSTONE.

The Lower Winifrede Sandstone of White[14], belonging in the Kanawha Valley immediately below the coal last described, attains a fair development in the territory of this Report, especially in southern Clay County. It is usually massive to current-bedded, medium-grained to coarse, micaceous, and gray to grayish-white and brown in color. Its thickness and relative position in the rock column are exhibited in the special sections given in Chapter IV for Widen—3 Miles Northeast, Clay, Wallowhole Knob—2 Miles Northeast, Wallback, Clay, and Greendale, in Clay County; in the log of the M. J. and E. W. King No. 6 Well—No. 169 on Map II, 1 mile northwest of Birch, Clay County. No quarries were observed on this ledge, but it is very similar in both texture and physical appearance to the Lower Coalburg and the Upper Winifrede ledges, and its wide outcrop exposures should furnish an abundance of stone adapted to the same uses.

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[14] I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 271; 1908.

THE WINIFREDE LIMESTONE.

The marine fossiliferous Winifrede Limestone of White[15], belonging at its type locality—Winifrede, Kanawha County—65 to 70 feet below the coal of the same name and 20 to 30 feet above the Chilton bed, is fairly persistent in Braxton and Clay, the fossiliferous limestone here being frequently replaced by marine fossiliferous shale. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Palmer, Holly—1.3 Miles Southwest, and Holly—0.8 Mile Southwest, in Braxton; and for Beech Fork of Lilly, in Clay County.

In **Braxton County**, its outcrop is confined to the valley walls of the Little Kanawha River, for a distance of 1 to 2 miles westward from Wildcat; to the waters of Elk River above a point about midway between Gillespie and Holly Junction; and to the waters of Little Birch River above Ramp Run. No exposures of this horizon were observed at either the first- or last-mentioned region, but along Elk, its outcrop was seen at several points. Southeastward along this river, it is first seen above drainage along the Baltimore and Ohio Railroad grade, 0.8 mile southwest of Holly Junction, at an elevation of 915′ B., where the following section was measured by the writer:

	Feet.
Sandstone, shaly, visible	5
Shale, buff, sandy	10
Shale, black, with limestone lenses, carrying marine fossils in abundance, Winifrede	4
Fire clay shale	2
Shale, sandy	2
Sandstone, shaly	2
Coal, Chilton? (8″) (905′ B.)	0.7
Fire clay shale to railroad grade	1

One mile northeastward on the West Virginia Midland Railroad grade just below Palmer Station, the Winifrede Limestone has been replaced by 6 feet of marine fossiliferous black shale, 90 feet below the undoubted Stockton Coal and less than 5 feet above what appears to be the Chilton seam as shown in the Palmer Section, page 97. W. A. Price, Volunteer

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[15] I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 431; 1908.

Paleontologist of the Survey, recently visited this exposure and made a fine collection of the marine fossils, the following species being recognized in the field from the many collected:

Chonetes granulifer.
Orbiculoidea capuliformis.
Derbya crassa ?
Marginifera wabashensis.
Productus sp.
Crinoid columns.
Aviculipecten ? sp.
Naiadites elongata.

A later detailed study of the fossil collection above mentioned revealed the following additional forms according to Dr. Price (See Chapter XII):

Enchostoma sp.
Chaetopod jaw.
Crinoidea, columns and spines,
Lingula kanawhensis
Orbiculoidea missouriensis
Derbya rubusta
Pustula symmetrica
Spirifer boonensis ?
Spiriferina kentuckyensis.
Composita subtilita.
Solenomya radiata ?
Deltopecten sp.
Pectenoidea indeterminata.
Allerisma guyandotensis.
Cypricardinia ? carbonaria ?
Ostracoda.

On the north bank of Holly River along the West Virginia Midland Railroad grade, the writer observed two exposures of this same marine fossiliferous shale, as exhibited in the Holly—1.3 Miles Southwest, and Holly—0.8 Mile Southwest Sections, pages 98 and 99, respectively. At the latter point, the horizon is represented in part by a fairly pure limestone with marine fossils in abundance.

In **Clay County,** the outcrop of the Winifrede Limestone horizon is confined to the valley walls of Buffalo Creek near Eakle; Robinson Fork, southeast of Eakle; and Lilly Fork near its intersection with the Clay-Nicholas County Line, its character and stratigraphic position here being shown in the Beech Fork of Lilly Section, page 139. Marine fossils occur in abundance, many species of types similar to those found at Palmer being represented. Its horizon also outcrops in this county on the waters of Twentymile and Bells Creeks, and along the valley walls of Elk River between the mouths of Beechy and Sycamore Creeks, but no exposures were observed.

The discovery of this marine fossil horizon by the writer, in conjunction with that of the Kanawha Black Flint, in the southeast portions of both Braxton and Clay is very important, in that the upper portion of the Kanawha Group is definitely fixed in the rock column for these far removed regions from the type locality of the latter measures in the Kanawha Valley. The completion of the detailed geologic reports of Webster, Nicholas, and Fayette Counties will very probably fix the position of the same marine fossil horizons in the Pottsville Series of the northern portion of the State.

THE CHILTON COAL.

The Chilton Coal of White[16], belonging at its type locality—Chilton, Kanawha County--70 feet below the Winifrede Coal and probably 10 to 20 feet below the Winifrede Limestone, outcrops in the same regions of each county as described above for the latter member, and, judging from the exposures observed, it does not appear to attain minable dimensions, purity, and regularity in either, with the possible exception of a narrow strip—1 to 2 miles wide—along the southeast edge of Buffalo, Henry, and Pleasant Districts, Clay County, where it is slightly over 3 feet in thickness, as shown in the Beech Fork of Lilly Section, page 139, and in the log of Coal Test Boring No. 50 on Map II, on Bells Creek, 0.4 mile west of the common corner of Clay, Nicholas, and Kanawha Counties. It is true that a fair thickness of coal is recorded at what appears to be the Chilton horizon in the logs of oil and gas wells Nos. 125 and 127 in Henry District; 128 and 130 in Pleasant District; and 140, 159, 169, 173, 181, 182, 183, 188, 190, and 201 in Union District, but the unreliability of such records as regards the thickness of actual coal in any bed encountered, in view of its poor showing at outcrop exposures, makes it very problematical whether or not it is merchantable in the regions of these borings. Its thickness and stratigraphic position are also exhibited in the special sections given in Chapter IV for Palmer, Holly—1.3 Miles Southwest, and Holly—0.8 Mile Southwest, in Braxton; for Sinnett Branch,

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[16] I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 430; 1908.

Schoonover Knob, Lick Branch of Adonijah, Marne—0.7 Mile West, and Bomont—1 Mile East, in Clay County; and in the logs of coal test borings Nos. 33, 46, and 49 on Map II.

In **Holly District** (Braxton), the following section was measured by the writer at the crop of this bed on the east hillside of Kanawha Run, 0.4 mile north of Holly:

Coal Exposure—No. 71 on Map II.

				Ft.	In.
Sandstone, flaggy, visible				15	0
Coal	0'	4"			
Slate	0	2			
Coal	0	9			
Slate, black	0	2			
Coal	0	4	Chilton (1040' B.)	1	9

In **Buffalo District** (Clay), a bed that appears to represent the Chilton crops along the Buffalo Creek and Gauley Railroad, 1 mile above Eakle at **Coal Exposure No. 72 on Map II,** where the following section was measured by the writer:

				Ft.	In.
Shale, sandy, visible				5	0
Sandstone, massive				5	0
Shale, bluish-gray, plant fossils				4	6
Coal, gas, medium-hard	0'	3½"	Chilton? (995' B.)	1	2
Slate, black	0	0½			
Coal, gas, medium-hard	0	10			
Shale, gray, argillaceous, to railroad grade				4	6

At the above exposure this bed comes about 480 feet below the horizon of the Upper Kittanning Coal,—a result that agrees closely with that obtained for the same interval in the Beech Fork of Lilly Section, page 139.

In the same region, this bed crops along the hillsides of Robinson Fork and has been prospected by natives for local domestic fuel, **Coal Exposure No. 73 on Map II,** on the north bank and 0.1 mile up the latter stream, having been examined by the writer, and the following section obtained:

				Ft.	In.
Sandstone, massive				30	0
Shale, sandy, fossil plants				4	0
Coal, gas, medium-hard	0'	2 "	Chilton? (950' B.)	1	3
Bone	0	0½			
Coal, gas, medium-hard	1	0½			
Fire clay shale				4	0
Shale, sandy, to bed of Robinson Fork				2	0

Six-tenths mile southeastward on the same hillside of Robinson Fork, **Coal Opening No. 74 on Map II** in the same bed had fallen shut when visited by the writer in 1915, but judged from the surface indications, the coal had about the same thickness.

Four-tenths mile southward on the east bank of Road Fork of Robinson, the following data were obtained by the writer at **Coal Opening No. 75 on Map II**:

				Ft.	In.
Shale, greenish-gray, sandy, plant fossils abundant				6	0
Coal, gas, medium-hard	0′	5″	Chilton? (1045′ B.)	1	9
Shale, dark, 1″ to	0	2			
Coal, gas, medium-hard	1	2			
Slate					

In the southern portion of **Henry District** (Clay), this bed rises above drainage on Leatherwood Creek, 2¼ miles northwest of Boardtree Gap, the following section being obtained by the writer from **Coal Opening No. 76 on Map II** in the **Chilton** on the west bank of the creek, 0.8 mile northwest of the mouth of Road Fork:

	Ft.	In.
Shale, sandy	7	0
Sandstone, massive	2	0
Shale, sandy and flaggy	2	0
Sandstone	0	6
Shale, bluish-gray	3	0
Coal, gas, medium-hard, Chilton (950′ B.)	1	3
Slate		

Coal Opening No. 77 on Map II in the same bed, on the south bank of Leatherwood, 0.9 mile eastward from the mouth of Road Fork, was closed when visited by the writer during 1915, but the coal is reported 2 to 3 feet in thickness and it belongs at practically the same interval below the Upper Kittanning Coal horizon as the openings and exposures of this seam described above in Clay County.

The thickness and character of the Chilton Coal at **Prospect Opening No. 78 on Map II,** located on the west bank of Lilly Fork, just across the line in the edge of Nicholas County, 0.6 mile southeast of the mouth of Beech, is exhibited in the Beech Fork of Lilly Section, page 139.

In the northern edge of **Pleasant District** (Clay), what appears to be the Chilton bed outcrops along the Coal and

Coke Railway grade, the following section being obtained by Gawthrop at **Coal Exposure No. 79 on Map II,** 0.3 mile southwest of the mouth of Little Beechy:

	Ft.	In.
Unrecorded from **Coalburg Coal** bench	100	0
Sandstone, massive	25	0
Coal, Chilton? (675' B.) 0' to	0	3
Sandstone to railroad grade	3	0

Six-tenths mile southwestward and along the same railroad grade, the same thickness of this bed is reported by Gawthrop at **Coal Exposure No. 80 on Map II,** at an elevation of 675' B.

THE HERNSHAW COAL.

The Hernshaw Coal of the writer and Reger[17], belonging at its type locality—Hernshaw, Kanawha County—175 feet below the Winifrede Coal and 120 feet above the Cedar Grove bed, appears to be present in the measures of Braxton and Clay, but too thin and irregular to be classed as a minable seam. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Holly—1.3 Miles Southwest, and Holly—0.8 Mile Southwest, in Braxton; for Beech Fork of Lilly and Lick Branch of Adonijah, in Clay County; and in the logs of Coal Test Borings Nos. 49 and 50 on Map II. These show it too thin and irregular to warrant further description.

The marine fossiliferous **Dingess Limestone** of the writer and Reger[18], belonging in the interval between the Hernshaw and Williamson Coals, was not observed in the territory of this Report.

THE HOLLY (WILLIAMSON?) COAL.

At 35 to 40 feet below the marine fossiliferous Winifrede Limestone in the vicinity of Holly, Braxton County, there occurs an impure coal, as shown in the sections given in Chapter IV for Holly—1.3 Miles Southwest, and Holly—0.8 Mile

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[17] Ray V. Hennen and D. B. Reger, Logan-Mingo Report, pp. 156-163; 1914.

[18] Ray V. Hennen and D. B. Reger, Logan-Mingo Report, pp. 165-6; 1914.

Southwest, pages 98 and 99, respectively, that appears to correlate with the **Williamson bed** of the writer and Reger[19]. As its position in the Kanawha measures is somewhat uncertain, it has been designated the **Holly Coal** with the name "**Williamson**" usually following in parentheses. In the Holly region, it generally carries from 4 to 12 inches of medium-soft gas coal at the bottom and 6 inches to 3 feet of bony cannel, grading into cannel slate, at the top. The latter feature makes it a valuable "key-rock" on the waters of Elk River above Palmer in tracing the measures in this forested region, since many fragments of cannel slate occur with frequency on the surface along its bench. Again, along Elk waters, this bed immediately overlies a heavy sandstone—possibly the Upper Cedar Grove—which forms steep slopes and frequent cliffs. In other localities, its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Centralia, Beech Fork of Lilly, Greendale, and Marne—0.7 Mile West; in the logs of oil and gas wells Nos. 127, 129, 131, 135, 138, 140, 179, 181, 185, and 188 on Map II; and in the records of Coal Test Borings Nos. 45, 46, 49, and 50 on Map II.

In **Holly District** (Braxton), at **Coal Exposures Nos. 80 and 81 on Map II,** located 1.3 miles and 0.8 mile southwest of Holly along the West Virginia Midland Railroad grade, the thickness and character of the Holly bed are shown in the sections published in Chapter IV for these points, pages 98 and 99, respectively.

On the south hillside of Holly River, 0.3 mile southward from Holly, the writer obtained the following data at the **S. G. Cutlip Coal Opening—No. 82 on Map II:**

		Ft.	In.
Sandstone, visible		1	0
Shale, dark		4	0
Cannel slate, black.....1' 6"	Holly (Williamson?).	2	8
Coal, medium-soft.......1 2	(1010' B.)		
Slate			

In the same District, **Coal Exposure No. 83 on Map II,** on the east bank of Kanawha Run, ½ mile due north of Holly, was examined by the writer, the following section being obtained:

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[19] Ray V. Hennen and D. B. Reger, Logan-Mingo Report, W. Va. Geol. Survey, pp. 166-8; 1914.

	Ft.	In.
Slate, black, with fossil plants, visible	0	2
Coal, Hernshaw?	0	3
Fire clay shale, dark	2	6
Sandstone, flaggy and hard	1	6
Shale, sandy	2	6
Cannel slate, black.....0′ 6″ } Holly (Williamson?).	0	11
Coal, medium-soft.......0 5 } (980′ B.)		
Shale, sandy, to bed of Kanawha Run	1	0

On the long point opposite the mouth of Laurelpatch Run of Left Fork of Holly River, slightly over a mile west of Marpleton, the writer obtained the following data at the **Brewster Heirs Prospect—No. 84 on Map II**:

	Ft.	In.
Sandstone, flaggy, visible	25	0
Coal, bony, Hernshaw?	4	0
Shale, gray and brown, with iron ore nodules	5	6
Cannel slate, black.....2′ 5″ } Holly (Williamson?).	3	7
Coal, medium-soft.......1 2 } (1165′ B.)		
Slate		

At **Coal Exposure No. 85 on Map II,** immediately north of the mouth of Laurelpatch Run, the blossom of the Holly Coal occurs at an elevation of 1130′ B., 100 feet higher than an opening in what appears to be the Cedar Grove bed.

Two miles northeastward in the same District, Gawthrop obtained the following data at the **James Browning Coal Prospect—No. 86 on Map II,** along the east hillside of Mudlick, 0.8 mile slightly north of west from Saffles Retreat Schoolhouse:

	Ft.	In.
Coal, Lower Kittanning (See Chapter X) (1525′ B.)	7	7
Slate	1	0
Sandstone	10	0
Concealed and unrecorded	270	0
Sandstone, shaly	2	0
Shale, dark, siliceous	5	0
Cannel slate, black.....2′ 2″ } Holly (Williamson?)	3	2
Coal, medium-soft.......1 0 } (1235′ B.)		
Shale		

At **Coal Exposure No. 87 on Map II** in what appears to be the Holly seam, just in the edge of Nicholas County, on the west hillside of Rockcamp Fork at Greendale, the writer obtained the following data:

				Ft.	In.
Unrecorded from **Coalburg Coal** at Mine No. 898 on Map II				165	0
Shale, sandy, visible				5	0
Cannel slate, siliceous	1'	8"	**Holly (Williamson?)**	1	11
Coal, bony	0	3	(970' B.)		
Fire clay shale				1	6
Slate, black, visible				3	6

It belongs here about 275 feet below the Kanawha Black Flint as opposed to about 225 below the same datum in the Beech Fork of Lilly Section, page 139.

A careful study of all the data gathered on the Holly Coal warrants the conclusion that it is too thin, impure, and irregular in its occurrence to be classed as a minable seam in the territory of this Report.

THE UPPER CEDAR GROVE SANDSTONE.

The Upper Cedar Grove Sandstone of the writer and Reger[20], belonging in the interval separating the Williamson and Cedar Grove Coals, is quite persistent in the southeast portions of each county. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Beech Fork of Lilly and Greendale. As mentioned above under the description of the Holly (Williamson?) Coal, it is a frequent cliff-maker immediately below the latter bed along the valley walls of Elk River and its larger tributaries in Braxton County. No quarries were observed on it. This ledge probably carries too much aluminous matter to be successfully used in crushed form as concrete aggregate, a feature that is characteristic of many of the sandstone beds in the lower two-thirds of the Kanawha Group.

The marine fossiliferous **Seth Limestone** of Krebs[21], belonging at its type locality—Seth, Boone County—in the shale interval separating the stratum last described from the underlying Cedar Grove Coal, was not observed, although its horizon should outcrop along the valley walls of Holly River above Holly, and Elk River above Palmer in Braxton; and low down near the beds of Rockcamp and Open Forks of Bells Creek in the southern point of Clay County.

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[20] Ray V. Hennen and D. B. Reger. Logan-Mingo Report, W. Va. Geol. Survey, pp. 169-170; 1914.

[21] C. E. Krebs, Boone County Report, W. Va. Geol. Survey, p. 155; 1915.

THE MARPLETON (CEDAR GROVE?) COAL.

In the vicinity of Marpleton, Braxton County, a bed, carrying both bituminous and cannel coal, has been opened by natives for local domestic fuel along both hillsides of Left Fork of Holly, at about 100 feet below the Holly (Williamson?) seam, that appears to correlate with the **Cedar Grove**[22] of the Kanawha Valley region. As its position in the measures, like that of the Holly bed, is somewhat doubtful, it is herein designated the **Marpleton Coal** with the name **"Cedar Grove"** usually following in parentheses. It is noted in the sections given in Chapter IV for Marpleton, Centralia, Beech Fork of Lilly, and Greendale; in the logs of oil and gas wells Nos. 128, 129, 135, 181, 188, and 244; and in the records of Coal Test Borings Nos. 45, 46, 49, and 50 on Map II. Its outcrop is confined to the same regions in each county as that outlined above for the horizon of the Seth Limestone. It has not been mined commercially in the area in question, but it appears to attain sufficient thickness, purity, and regularity along the southeastern edges of Braxton and Clay to warrant its classification as a minable seam. Its character at country banks and crop exposures and its approximate minable area as limited on Figure 15, are described on subsequent pages in Chapter-X, along with an estimate of its available tonnage.

The Middle Cedar Grove Sandstone, Lower Cedar Grove Coal, Lower Cedar Grove Sandstone, Alma "A" and Alma Coals, Monitor ("Logan") Sandstone, and Little Alma Coal of the writer and Reger[23], in the descending order of their occurrence in Logan and Mingo Counties, were not observed in the territory of this Report, although their horizons outcrop in Braxton County along the valley walls of Holly River above Holly P. O., and Elk River about Bakers Run Station.

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[22] I. C. White, Bull. 65, U. S. Geol. Survey, pp. 138-140; 1891; and Vol. II, W. Va. Geol. Survey, p. 562; 1903.

[23] Ray V. Hennen and D. B. Reger, Logan-Mingo Report, W. Va. Geol. Survey, pp. 172-183; 1914.

THE PEERLESS SANDSTONE.

The Peerless Sandstone of Krebs[24], belonging at its type locality in the Kanawha Valley region 5 to 20 feet above the Peerless division of the Campbell Creek Coal, was observed at only one point, as shown in the section below, although its outcrop should occur along the valley walls of Left Fork above Marpleton, Right Fork of Holly above Cabin Run, and Elk River above Bakers Run Station. It is recorded in the log of Coal Test Boring No. 45 on Map II, the details of which are published in connection with the Beech Fork of Lilly Section, page 139.

The **Campbell Creek Limestone** of White[25], belonging at its type locality—mouth of Campbell Creek, Kanawha County—in the interval separating the sandstone last described from the underlying Campbell Creek Coal, was observed at only one point as shown in the following section measured with aneroid by the writer on the west hillside of Elk River to the Baltimore and Ohio Railroad grade, 1.2 miles N. 10° W. of Centralia, the 3-inch seam of coal near the base apparently correlating with the Peerless division of the Campbell Creek bed:

	Thickness.		Total.		
	Ft.	In.	Ft.	In.	
Coal blossom, Holly, in road (1085′ B.)...	1	0	1	0	
Concealed................................	80	0	81	0	
Sandstone, medium-grained, current-bedded, making great cliff, **Peerless**......	25	0	106	0	
Shale, dark, laminated, siliceous, with lenses of **Campbell Creek Limestone**, 18″ in diameter......................	30	0	136	0	136′
Slate, black, with **Lingulae** and plant fossils at base.........................	4	9	140	9	
Coal, Peerless? (945′ B.)................	0	3	141	0	
Shale, gray, to B. & O. R. R. grade.......	5	0	146	0	10′

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[24] C. E. Krebs, Kanawha County Report, W. Va. Geol. Survey, p. 281; 1914.

[25] I. C. White, Bull. 65, U. S. Geol. Survey, p. 168; 1891; and Vol. II, W. Va. Geol. Survey, p. 566; 1903.

THE CAMPBELL CREEK ("NO. 2 GAS") COAL.

The Campbell Creek Coal of White[26], belonging at its type locality—Campbell Creek, Kanawha County—20 to 30 feet below the limestone last described, appears to be poorly represented in the eastern border of Holly District (Braxton), the only region it rises above drainage. Its thickness and stratigraphic position are exhibited in the special sections given in Chapter IV for Beech Fork of Lilly, Lick Branch of Adonijah, and Greendale; in the logs of oil and gas wells Nos. 74, 128, 130, 144, 206, 208, 210, and 232; and the records of Coal Test Borings Nos. 45, 49, and 50 on Map II. Along the southeast edge of each county, judging from well records, it is believed to attain sufficient thickness and regularity to be classed as a minable seam in the southern edge of Clay County. Its approximate minable area, as limited on Figure 5 along with that of the Bakerstown and Sewell beds, is described on subsequent pages in Chapter X, along with an estimate of its available tonnage.

THE BROWNSTOWN SANDSTONE.

The Brownstown Sandstone of White[27], belonging at its type locality—Brownstown, Kanawha County—immediately below the Campbell Creek Coal, was not recognized, but its horizon crops low down along both forks of Holly River above Holly P. O., and Elk River, above the mouth of Mill Creek. It is recorded in the log of Coal Test Boring No. 45 on Map II, the details of which are given in Chapter IV in connection with the Beech Fork of Lilly Section, page 139.

THE POWELLTON (BROWNSTOWN) COAL.

The Powellton (Brownstown) Coal of White[28], belonging at its type locality—Brownstown, Kanawha County—70 feet below the Campbell Creek Coal and 20 to 40 feet below the sandstone last described, appears to be of scanty occurrence in the territory of this Report, the outcrop of its horizon being confined to the same regions as that given above for the Brownstown Sandstone, but no coal was observed. In southeastern Clay County, it appears to be this coal that is reported in the logs of two borings, the details of which are given in Chapter IV in connection with the sections for Sinnett Branch of Lilly and Beech Fork of Lilly, pages 135 and 139, respectively.

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[26] I. C. White, Bull. 65, U. S. Geol. Survey, p. 170; 1891; and Vol. II, W. Va. Geol. Survey, p. 567-85.

[27] I. C. White, Vol. II, W. Va. Geol. Survey, p. 586; 1903.

[28] I. C. White, W. Va. Geol. Survey, Vol. II, pp. 511 and 585; 1903; and Vol. II(A), pp. 272 and 349; 1908.

THE EAGLE SANDSTONE.

The Eagle Sandstone of the writer and Reger[29], belonging immediately above the coal of the same name, crops along the valley walls of Elk River and Laurel Creek eastward and southeastward from Centralia, where it forms cliffs 20 to 30 feet in height, 0 to 10 feet above the Eagle Coal as shown in Openings Nos. 955-961. In southeastern Clay County, it is reported in the log of Coal Test Boring No. 45 on Map II, used in connection with the Beech Fork of Lilly Section, page 139.

THE EAGLE COAL.

The Eagle Coal of White[30], belonging at its type locality—Eagle, Fayette County—135 to 140 feet below the Campbell Creek bed and 75 to 80 feet above the marine fossiliferous Eagle Limestone, appears to be represented by a multiple-bedded seam in the southeastern border of Holly District, Braxton County, belonging 125 to 140 feet below the Marpleton (Cedar Grove) Coal and ranging in thickness from 2 to 4 feet, that has been prospected considerably by natives for local domestic fuel along Left Fork of Holly above Marpleton; Elk River, above Centralia; and Laurel Creek, southwest of the latter town. In the Centralia Section, page 101, its horizon should belong in the concealed interval 890 to 900 feet from the top. In Clay County its thickness and stratigraphic position are exhibited in the sections given in Chapter IV for

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[29] Ray V. Hennen and D. B. Reger, Logan-Mingo Report, W. Va. Geol. Survey, pp. 202-203; 1914.

[30] I. C. White, Bull. 65, U. S. Geol. Survey, p. 140; 1891; and Vol. II, W. Va. Geol. Survey, p. 587; 1903.

Sinnett Branch of Lilly and Beech Fork of Lilly, pages 135 and 139, respectively; and in the logs of wells Nos. 127, 130, and 238 on Map II. The section given on a subsequent page of this Chapter under the description of the Eagle Limestone and Shale apparently establishes its correlation in Braxton County where it outcrops along Holly and Elk Rivers and attains sufficient thickness and regularity to warrant its classification as a merchantable bed. Its character in this region and its approximate minable area, as limited on Figure 4 on a subsequent page, along with that for the Pittsburgh Coal, will be described in Chapter X.

THE DECOTA SANDSTONE.

The Decota Sandstone of Krebs[31], belonging at its type locality—Decota, Kanawha County—in the interval separating the coal last described from the underlying Little Eagle bed, was observed at only one point, as shown in the section given below under the description of the Eagle Limestone and Shale.

THE LITTLE EAGLE COAL.

The Little Eagle Coal of White[32], belonging at its type locality — Eagle, Fayette County — immediately below the stratum last described and 20 to 30 feet below the Eagle seam, appears to be of scanty occurrence in the territory of this Report, seldom exceeding 1 foot in thickness and belonging 25 to 35 feet below the Eagle bed. Its outcrop is confined to the waters of Left Fork of Holly above Marpleton; Right Fork above Fall Run; and Elk River above a point one-half mile below Centralia. It is only 6 inches in thickness at an exposure on the north bank of Oldlick Creek, ½ mile southeast of Marpleton, as shown in the section below under the description of the Eagle Limestone. It appears to be this bed that is represented at **Coal Prospect No. 88 on Map II,** on the east bank of Elk River, 0.4 mile north of Centralia, at an elevation of 945′ B., as determined by the writer, where 16 inches of coal is visible, the digging being so closed that the total bed-section could not be obtained. A few hundred feet southward, on the same side of Elk, however, it is less than 6 inches in thickness at a crop exposure. According to W. T. Diggins of Centralia, 24 inches of coal at this horizon is visible in the bed of Laurel Creek during very low water stages, 0.7 mile southwest of Centralia. The writer was unable to verify this on account of high water when the point was visited in 1915. Here, the bed of the stream has an elevation of 970′ B., or 30 to 40 feet below the horizon of the Eagle Coal—prospected about ¼ mile farther up Laurel at Openings Nos. 958 and 959 on Map II. In southeastern Clay County, it appears to be this coal that is recorded in the log of Coal Test Boring No. 45, used in connection with the Beech Fork of Lilly Section, page 139. The bed is too thin and irregular to warrant its classification as a minable seam.

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[31] C. E. Krebs, Kanawha County Report, W. Va. Geol. Survey, p. 292; 1914.

[32] I. C. White, Bull. 65, U. S. Geol. Survey, p. 177; 1891; and Vol. II, W. Va. Geol. Survey, pp. 592-3; 1903.

THE EAGLE LIMESTONE AND SHALE.

The marine fossiliferous Eagle Limestone and Shale of White[88], belonging at its type locality—Eagle, Fayette County—75 to 80 feet below the Eagle Coal and 55 to 60 feet below the Little Eagle bed, was observed at only one exposure in the territory of this Report, as shown in the following section measured by the writer in the eastern edge of Holly District, Braxton County, on the north hillside of Oldlick Creek, about one-half mile southeast of Marpleton:

	Feet.
Coal, Eagle	2.3
Shale	5
Sandstone, **Decota**, massive	15
Shale, black	20
Coal, soft, Little Eagle (1020′ B.)	0.5
Shale, gray	2
Sandstone, shaly and flaggy	11
Limestone, Eagle, impure, lenticular, 0 to	1
Sandstone, shaly and flaggy	3
Shale, Eagle, black, with Lingulae fossils, to railroad grade	13

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[88] I. C. White, Bull. 65, U. S. Geol. Survey, pp. 140 and 177; 1891; and Vol. II, W. Va. Geol. Survey, p. 593; 1903.

The members of the Kanawha Group below that last described, as also those of the New River Group--see General Section of the Pottsville Series at the beginning of this Chapter, pages 250-2, lie below drainage, the only source of information concerning them being the logs of oil and gas well borings and the record of Coal Test Boring No. 45, mentioned above, to which the reader is referred.

The **Sewell Coal** of the New River Group is described on subsequent pages in Chapter X.

PART III.

Mineral Resources.

CHAPTER IX.

PETROLEUM AND NATURAL GAS.

OIL AND GAS HORIZONS.

The territory of this Report has only within the last three or four years attracted much attention as regards its petroleum and natural gas resources as a result of the opening in Braxton County of the Stray and Gordon gas pools, just west of the crest of the Orlando Anticline, northeast of Burnsville, and the Salt Sand oil pool at Rosedale; and in Clay, of the Big Injun oil pool in the eastern edge of Union District, and the gas pool immediately to the west and southwestward in the latter area along the crest of the Chestnut Ridge Anticline. These pools corroborate the structural theory of gravity separation as first advanced by White[1], as described fully on subsequent pages of this Chapter. All the oil yet produced is of the famous Pennsylvania or "amber" grade, having a paraffine base and being rich in the volatile hydrocarbons. The zones in which both the oil and gas occur are the sandstone members of the Pennsylvanian, Mississippian, and Devonian rocks, not any having been encountered in the Permo-Carboniferous or Dunkard Series above, or in the Chemung and Portage divisions of the Devonian. However, only 4 wells (Nos. 77, 102, 109D, and 109E on Map II) in Braxton, and 5 wells (Nos. 114, 115, 120, 125, and 135 on Map II) in Clay County, have penetrated to a depth sufficient to test those in the Chemung; and none, in the Portage. The "Big Lime", or Greenbrier Limestone of the Mississippian, frequently contains shows of oil and gas, but, with one exception—J. C. Gerwig No. 1 Well (No. 70A on Map II)—has not produced either in paying quantities, and no other limestone of importance is present above the base of the Devonian.

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[1] I. C. White, "Science," June 26, 1885; W. Va. Geol. Survey, Vol. I, pp. 159-187; 1899; and Vol. I(a), p. 48; 1904.

The following table gives the names and classification of the several oil and gas sands, as compiled from previous Reports of the West Virginia Geological Survey[2], and it shows not only the producing zones of Braxton and Clay, but also those in other portions of the State, the zones known to be productive in the two counties in question being printed in **black face type**:

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[2] Ray V. Hennen, Monongalia-Marion-Taylor Report, p. 388; 1913; and D. B. Reger, Lewis-Gilmer Report, p. 176; 1916.

Table Showing Oil and Gas Zones of West Virginia.

Pennsylvanian:	
Monongahela Series	Carroll Sand (Uniontown)
Conemaugh Series	Minshall Sand (Connellsville).
	Murphy Sand (Morgantown).
	Moundsville Sand (Saltsburg).
	First Cow Run or Little Dunkard Sand (Buffalo).
	Big Dunkard Sand (Mahoning).
Allegheny Series	Burning Springs Sand (Upper Freeport).
	Gas Sand of Marion and Monongalia Counties (Lower Freeport).
Pottsville Series	Second Cow Run of Ohio (Homewood).
	Cairo Gas Sand.
	Cairo Salt Sand (Connoquenessing).
	Cairo?
	Rosedale Gas Sand.
	Rosedale Salt Sand.
Mississippian:	
Mauch Chunk Series	Maxton, Dawson, Cairo?
	Little Lime.
Greenbrier Limestone	Big Lime, not generally productive.
Pocono Sandstones	Keener Sand and Beckett Sand of Milton.
	Big Injun Sand.
	Squaw Sand.
	Weir Sand.
	Berea Sand.
Devonian:	
Catskill Red Beds	Gantz Sand.
	Fifty-foot Sand.
	Thirty-foot Sand.
	Gordon Stray Sand.
	Gordon Sand.
	Fourth Sand.
	Fifth or McDonald Sand.
	Sixth or Bayard Sand.
	Seventh or Elizabeth Sand.
Chemung and Portage Beds	Warren First or Second, Tiona, Speechley Sand. No well-defined oil or gas horizons yet discovered in West Virginia.

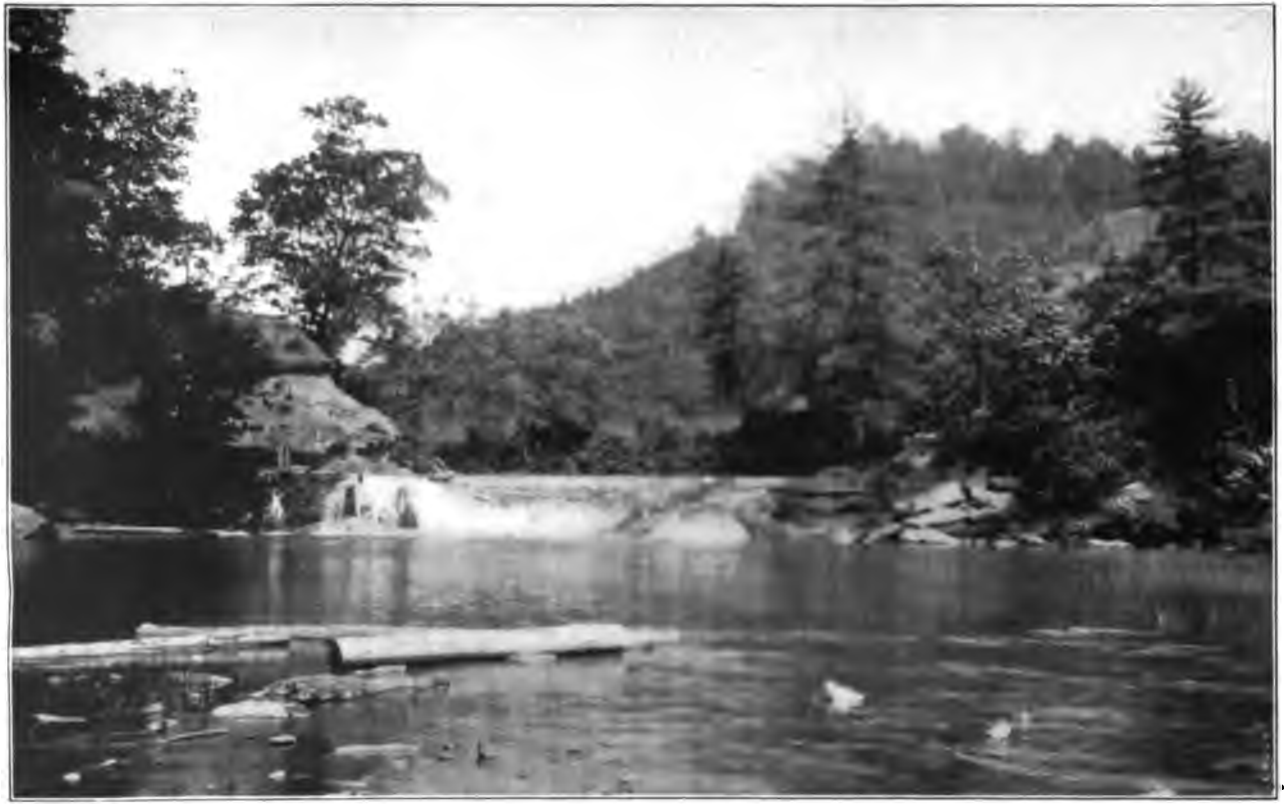

PLATE XI.—Showing the falls in the Little Kanawha River at Falls Mill, Braxton County, exposed ledges in Allegheny Series.

In the foregoing table, the Gas Sand of Marion and Monongalia Counties has been placed in the Allegheny Series where it belongs and as it was described by the writer on page 391 of the Monongalia-Marion-Taylor Report, instead of in the Pottsville—a printing error on page 388 of the latter and subsequent County Reports. In Braxton and Clay, oil and gas in paying quantities were not found in all the sands in **black face type**, as in some of these only shows were encountered, those belonging to this class being the Maxton, Weir, Berea, and Thirty-foot. Owing to the rapid thickening of the Pottsville and Mauch Chunk Series southward and southwestward across the area, it was not deemed advisable to give a table of intervals from some known surface stratum down to these producing sands, the reader, instead, being referred to the summarized tables of well records for each county for the relative position of the producing zones; as also the tables at the beginning of Chapter III, pages 26-28, for Big Injun Sand; and for more detailed information for any particular region, to the more complete records of the wells in that locality.

DESCRIPTION OF OIL- AND GAS-BEARING SANDS.

THE CAIRO SALT SAND.

The Cairo Salt Sand, so designated from a town of that name in Ritchie County, is generally present in northern Braxton where shows of gas and oil have been encountered in it, but not in paying quantities. It usually carries more or less salt water. The rapid expansion of the Pottsville Series southward and southwestward renders its identity in the drilling records more or less uncertain.

THE ROSEDALE GAS SAND.

The Rosedale Gas Sand, so designated by Reger[3] from the town of Rosedale, Braxton County, where gas in commercial quantities has been produced from it, belongs there 1500 to 1525 feet below the horizon of the Pittsburgh Coal, 550 feet below the top of the Pottsville Series, and is locally referred to by the drillers as the "Gas Sand". It appears to correlate with one of the many divisions of the Salt Sand recorded in other portions of the State, and also with the Nuttall Sandstone at the top of the New River Group. In Union District, Clay County, shows of oil and gas have been encountered in a sand that seems to belong at the same horizon.

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[3] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, p. 178; 1916.

THE ROSEDALE SALT SAND.

The Rosedale Salt Sand, so designated by Reger[4] from Rosedale, Braxton County, where it has proved to be a prolific oil zone, belongs about 100 feet lower in the measures than the sand last described and frequently attains a thickness of 150 to 200 feet in the southwestern portion of the latter area and even greater in Clay County. It usually carries large pays of salt water, especially low down along the synclinal basins. It appears to belong below the Nuttall Sandstone of the New River Group of the Pottsville.

THE MAXTON SAND.

The Maxton Sand, belonging in the Mauch Chunk Red Beds, has not, so far as known, produced oil and gas in commercial quantity in either county, but in western Clay, just southwest of Eldorado and east of Marne, oil shows were encountered in this zone at wells Nos. 128 and 144 on Map II. In several other counties of the State, it has proved a very prolific horizon for both oil and gas.

THE BIG LIME.

The Big Lime, or Greenbrier Limestone of the Mississippian, belonging from 1700 feet in northeastern Braxton to 3000 feet in southern Clay below the horizon of the Pittsburgh Coal and having a thickness of 50 to 150 feet, carries showings of oil and gas at several scattered wells. One of the largest initial—for the first few hours—gas producers in either county was recently (May 5, 1916) reported from this zone at the Gerwig No. 1 well (No. 70A on Map II), on Left Fork of Steer Creek in Braxton County, 0.8 mile northwest of Chapel. When the gas pay was first tapped, its flow was estimated at the rate of 30 million cubic feet daily, falling off to about 1 million cubic feet daily at the end of 24 hours. The oil from this horizon is generally darker and slightly heavier than that found in sands.

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[4] Ibid.

THE KEENER SAND.

The Keener Sand, belonging directly below the zone last described, representing a split off the Big Injun proper of western Pennsylvania, and ranging in thickness from 20 to 40 feet, is a prominent gas zone in the western portion of Union District, Clay County. It is usually separated from the underlying Big Injun Sand by 1 to 20 feet of slate, but sometimes entirely merged with the latter.

THE BIG INJUN SAND.

The Big Injun Sand, as limited in West Virginia, often includes in one sandstone mass the zone last described and the underlying Squaw Sand. At widely scattered points in each county, its intervals below the Pittsburgh and Upper Kittanning Coal horizons are shown in the two tables at the beginning of Chapter III, pages 26 and 27-28, respectively. The largest oil pool yet developed in either county occurs in this zone along the east edge of Union District, Clay County. Southward and westward from this pool in the same District, the Big Injun Sand is a very prolific gas zone. Its thickness is quite variable, ranging from 50 to 150 feet, and it is the most important member of the Pocono Series.

THE SQUAW SAND.

The Squaw Sand, belonging in the Pocono Series and representing a split off the Big Injun proper of western Pennsylvania, has not produced oil or gas in paying quantities in either county, so far as known to the writer, unless the Weir

Sand of Krebs[5], so designated from Weir, Kanawha County, where it is a prominent oil-producing zone, should prove to be the same horizon. A flow of gas is reported from the latter sand in well No. 227 on Map II, located on Falling Rock Creek, just across the Clay-Kanawha Line in the edge of Kanawha County.

THE BEREA SAND.

The Berea Sand or basal member of the Pocono Series, belonging 400 to 500 feet below the top of the Big Lime and 200 to 300 feet below the base of the Big Injun, has not produced either oil or gas in paying quantities, although shows are reported in some of the wells in each county.

THE GORDON STRAY SAND.

The Gordon Stray Sand, belonging in the area in question 575 to 650 feet below the top of the Big Injun and ranging in thickness from 10 to 50 feet, is an important gas-producing zone in the northern edge of Salt Lick District, Braxton County, but throughout the two counties it is more or less lenticular in its occurrence, a feature that is characteristic of all the other sandstone members of the Catskill Series.

THE GORDON SAND.

The Gordon Sand, belonging 600 to 675 feet below the top of the Big Injun and seldom exceeding 30 feet in thickness, has produced both oil and gas on a commercial basis in the northern half of Salt Lick District, Braxton County, but not any worthy of mention in either county away from this region, due, in a large measure, to the lenticular character of the sand which seems to thin out and disappear southwestward from the Little Kanawha River.

THE FIFTH SAND.

The Fifth Sand, belonging 100 to 150 feet below the top of the Gordon, does not appear to have produced either oil or gas in commercial quantities in Braxton or Clay, but shows of each have been encountered in this zone in and along the northern portion of the former county.

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[5] C. E. Krebs, Kanawha County Report, W. Va. Geol. Survey, pp. 302-3; 1914.

WELL RECORDS AND PROSPECTIVE AREAS, BRAXTON COUNTY.

EARLY HISTORY.

The first successful attempts to find oil and gas in Braxton County date back about 16 years when a small Gordon Sand oil well—No. 24 on Map II—was completed on the Wilson Heirs farm on Longshoal Run, 1.5 miles northeast of Gilmer Station; and two light gassers from the same zone—1 and 2 on Map II—on the Robinette farm, on Left Fork of Oil Creek, 1.4 miles northeast of Burnsville. Four to five years later in the same District (Salt Lick), 2 or 3 light Gordon Sand gas producers were drilled on Hyers Run, 2 miles west of Burnsville, and during the last 3 or 4 years, considerable drilling activity has prevailed in the development of the gas field on the waters of Left Fork and Posey Run of Oil Creek, and the Salt Sand oil pool at Rosedale.

SUMMARIZED RECORDS.

The following table, compiled from the detailed logs of Braxton County wells and those in the immediately adjoining regions of Calhoun, Roane, Gilmer, Lewis, and Webster, shows at a glance important data concerning them, giving not only at each margin of the page the serial number indicating it in the text and on Map II, but also its elevation above sea-level, depth to the Upper Kittanning Coal when recorded, principal sands; viz, Big Injun, Berea, Gordon, and Fifth; total depth; and names of producing zones. No log could be obtained for many of these borings, but something concerning their history was found in almost every case. In the elevation column, the letter "B" indicates barometric determinations, checked by U. S. Geological Survey spirit levels; and the letter "L", spirit-level measurements. Throughout the text, the name of any well, when mentioned, is accompanied by its corresponding serial number on Map II, and in the

Summarized Record of Oil and

No. on Map II.	FARM NAME, LOCAL WELL AND NUMBER	Magisterial District.	OWNER	Elevation Above Tide
1	Geo. Robinette No. 2	Salt Lick	Pittsburgh & W. Va	815B
2	Geo. Robinette No. 1	Salt Lick	Pittsburgh & W. Va	810B
3	Mary F. Ritter No. 3811	Salt Lick	Hope	900B
4	Belle Crutchfield No. 3812	Salt Lick	Hope	1235B
5	Martha Mick No. 3875	Salt Lick	Hope	1275B
5A	P. S. Posey No.3833	Salt Lick	Hope	925B
6	E. J. Posey No. 7021	Salt Lick	Pittsburgh & W. Va	825B
7	W. T. Riffle No. 7033	Salt Lick	Pittsburgh & W. Va	920B
8	R. P. Waters Heirs No. 8	Salt Lick	Snaith & Wilson	1120B
9	Thos. Conley No. 7020	Salt Lick	Pittsburgh & W. Va	875B
10	A. M. Donahue No. 7032	Salt Lick	Pittsburgh & W. Va	....
11	R. P. Waters Heirs No. 6	Salt Lick	Snaith & Wilson	1230B
12	Hudson Mick No. 3267	Salt Lick	Hope	1265L
13	R. P. Waters Heirs No. 5	Salt Lick	Snaith & Wilson	1232L
14	Samuel Heater No. 3256	(Gilmer Co.)	Hope	1170B
15	Peter Sweeney No. 7010	(Gilmer Co.)	Pittsburgh & W. Va	1160B
16	Fred G. Hoover No. 1	Salt Lick (B)	....	....
17	R. P. Waters Heirs No. 7	(Lewis Co.)	Snaith & Wilson	....
18	R. P. Waters Heirs No.4	(Lewis Co.)	Snaith & Wilson	880B
19	Patrick Dolan Heirs No. 1	(Lewis Co.)	Hope	1050B
20	J. H. Groves No. 2738	(Lewis Co.)	Hope	810B
21	G. W. Bennett No. 7018	(Lewis Co.)	Pittsburgh & W. Va	900B
22	Fred Hoover No. 1	Salt Lick	Guffey	895B
23	L. W. McNair Heirs No. 1	Salt Lick	South Penn	825B
23A	L. W. McNair Heirs No. 4	Salt Lick	South Penn	....
24	Wilson Heirs No. 1	Salt Lick	Guffey	820B
25	L. W. McNair Heirs No. 2	(Gilmer Co.)	South Penn	1277B
26	R. R. Marshall No. 1	(Gilmer Co.)	Guffey	865B
27	R. R. Marshall No. 2	(Gilmer Co.)	Guffey	905B
28	H. S. Hefner No. 1	(Gilmer Co.)	Guffey	740B
29	R. R. Marshall No. 2	(Gilmer Co.)	Guffey	860B
30	C. S. Hudnall No. 2	(Gilmer Co.)	Gilmer O & G	770B
31	C. S. Hudnall No. 2	(Gilmer Co.)	Guffey	765B
32	C. S. Hudnall No. 1	(Gilmer Co.)	Guffey	760B
33	C. S. Hudnall No. 1	(Gilmer Co.)	Gilmer O. & G	820B
34	W. T. Brosius No. 1	Salt Lick	Unity	835B
34A	Rogers No. 1	Salt Lick	Hope	....
35	A. T. Compton No. 1	Salt Lick	Wm. O'Hare	760B
36	John I. Bender No. 1	Salt Lick	Wm. O'Hare	840B
37	John I. Bender No. 2	Salt Lick	Wm. O'Hare	900B
38	W. P. Knight No. 2	Salt Lick	Hope	785B
39	W. A. Nicholson No. 2408	Salt Lick	Hope	880B
40	F. R. Ball No. 2406	Salt Lick	Hope	820B
41	W. P. Knight No. 1	Salt Lick	Hope	850B
41A	John I. Bender (36A) No. 1	Salt Lick	Hope	....
42	Fred Hoover No. 2	Salt Lick	Wm. O'Hare ?	755B
43	Fred Hoover No. 1	Salt Lick	Wm. O'Hare ?	770B
44	Marshall No. 1	Salt Lick	Ward et al	775B
45	Wm. S. Hefner No. 1	Salt Lick	Zahnizer Bros	795B
46	R. O. Toms No. 1	Salt Lick	T. C. Story et al	790B
46A	R. D. Dennison No. 1	Salt Lick	Hope	....
47	R. D. Dennison No. 1	Salt Lick	D. J. Carter et al	862B
48	M. M. Queen No. 2351	Salt Lick	Hope	810B
49	L. D. Currence No. 1	Salt Lick	T. N. Barnsdale	770B
50	Samuel Cunningham No. 1	Salt Lick	John Farner	920B
51	Harvey Ware No. 1	Salt Lick	John Farner	1015B
52	G. D. Walton No. 1	Salt Lick	E. G Davisson	940B
53	E. G. Davisson No. 1	(Lewis Co.)	E. G. Davisson	1090
54	W. T. Wilson No. 1	(Lewis Co.)	Wilson & Butcher	992L
55	W. T. Wilson No. 2	(Lewis Co.)	Wilson & Butcher	1015B
56	A. K. Wilson No. 2	(Lewis Co.)	Wilson & Butcher	1010B
57	A. K. Wilson No. 1	(Lewis Co.)	Wilson & Butcher	1010B
58	S. M. Holt No. 1	(Lewis Co.)	John Farner	1020B
59	V. S. Lynch No. 1	(Lewis Co.)	Sparling & Neely	1035B
60	Wm. Mearns No. 1	(Upshur Co.)	Sparling	1075B
61	S. M. Holt No. 3	(Lewis Co.)	Sparling	....

Gas Wells in Braxton County.

Upper Kittanning Coal (Base)		BIG INJUN SAND (Top)		Berea Sand (Top)	Gordon Sand (Top)	5th Sand (Top)	Total Depth Feet	PRODUCING SAND AND REMARKS	No. on Map II
Depth	Elev. A. T.	Depth	Elev. B. T.						
								Gasser	1
		1660	850		2170	2310	2800	Gord. gas; 5th oil show	2
		1701	801		2254	2278	2320	Stray and Gord. gas	3
		2041	806		2580	2605	2717	Stray and Gord. gas	4
		1999	724		2635		2651	B. I. gas, 1,470,000′	5
		1700	775		2262	2440	2522	Gord. gas, 476,000′	5A
		1605	880		2140		2202	Stray, gas, 970 lbs. R. P.	6
		1640	720				2240	Stray gas, 2½ million	7
		1840	720		2464		2675	Stray gas, 1 million	8
		1565	790		2214		2238	Stray and Gord. gas	9
		2208	898		2732		2774	Stray and Gord. gas	10
		1990	760		2651		2679	B. I., Stray and Gord. gas	11
		2029	764		2670		2699	Stray and Gord. gas	12
		2969	728				2665	B. I., 30-ft., and Stray gas	13
		1930	760		2644		2667	Max., B. I., Stray and Gord. gas.	14
		2100					2655	B. I., and Stray gas	15
								Stray gas, Gord. gas show	16
		1950		2207	2527		2566	Max., 30-ft., and Stray gas	17
		1500	620		2139		2195	Stray gas	18
									19
		1606	796	1949			2571	Berea gas show	20
		1715	815	2020	2150		2760	Gord. gas. 100,000′	21
								Dry	22
		1725			2338		2904	Gord. oil, B. I. gas	23
							1626	Salt oil	23A
								Gord. oil show	24
		2357	1080		2838			Gord. oil and gas	25
								Dry — oil show	26
								Dry — gas show	27
								Dry	28
								Dry	29
		1848	1078			2639	2672	B. I. and 5th oil and gas shows	30
								Gasser	31
		1885	1120		2502	2655	2672	5th oil show	32
		1953	1133			2738	2772	Salt and 5th gas shows	33
		1738	908	2050			2557½	Salt gas show at 1475′	34
								Dry	34A
								Gasser in Gord	35
								Gasser in Gord	36
								Dry	37
								Gasser in Gord	38
					2295		2490	Gord. gasser, Salt oil show	39
								Gasser in Gord	40
								Gasser in Gord	41
								Gasser	41A
								Gasser in Gord	42
								Dry	43
		1675	900	1987			2282	Salt, B. I., and Berea oil shows	44
		1705	910				2640	Dry — Oil and Gas shows	45
							(1200)	Dry	46
		1972			2543	2710	2711	B. I. gas, small	46A
		1734	872		2277	2342	2456	Salt gas and oil; Gord. gas	47
418	392	1644	834		2265	2463	2952	Dry	48
(490)	(280)						(2700)	Dry	49
								Oil show in 5th	50
							(1800)	Oil and gas shows reported	51
		1300	360	1548	1943	2059	2464	B. Lm. oil and gas shows	52
								B. I. oil and gas shows	53
								Salt oil	54
							502	Max. gas show	55
		1065	55		1475	1670	2014	Salt oil, 5th oil show	56
								Salt oil	57
								Salt oil	58
								Dry	59
								Salt oil	60
								Dry	61

Summarized Record of Oil and Gas

No. on Map II	FARM NAME LOCAL WELL AND NUMBER	Magisterial District	OWNER	Elevation Above Tide
62	S. M. Holt No. 2	(Lewis Co.)	John Farner	1060B
63	John Snyder No. 1	(Upshur Co.)	Sparling & Neely	1120B
64	G. G. Butcher No. 1	(Lewis Co.)	Sparling	1107L
65	J. W. Loke No. 1	(Lewis Co.)	Hague	1250B
66	Wm. Mullins No. 1	(Webster Co.)	Story & O'Hare	1205B
67	Vandervort & Pickens No. 1	(Webster Co.)	Haddix	1220B
67A	Bernie Ptomey No. 1	Salt Lick		
67B	M. A. Barrett No. 1	Salt Lick	Pittsburgh & W. Va	
67C	Lee Ratliff No. 1	Salt Lick	Hope	
67D	J. F. Feeney No. 1	Salt Lick		
67E	L. J. Shock No. 1	Salt Lick	Hope	
67F	J. M. Taggart No. 1	Salt Lick	Hope	
68	Samuel Burk No. 1	(Gilmer Co.)	South Penn	795B
69	A. L. Jack No. 1	Otter	South Penn	815B
69A	Shock Heirs No. 1	Otter	Victoria	(1020B)
70	H. B. Gerwig No. 1	Otter	Ash Bros	895L
70A	J. C. Gerwig No. 1	Otter	Eastern	920B
71	J. G. Perrine No. 2350	Otter	Hope	1060B
71A	J. O. McCoy No. 1	(Gilmer Co.)	South Penn	785L
72	Jas. J. Stalnaker No. 1	Otter	Crooked Fork	910B
73	T. V. Shock No. 1	(Gilmer Co.)	South Penn	780B
73A	Berry Heirs No. 1	(Gilmer Co.)	Matych & Wilkins	820B
74	A. Mayer No. 1	Otter	McCoy et al	775B
75	Silas Carr No. 2617	Otter	Hope	1120B
76	Fred Depoy No. 1	Otter	Benedum & Trees	845B
77	Haymond No. 1	Otter	South Penn	835B
78	C. N. Snodgrass No. 1	(Gilmer Co.)	Jessop P. & Co	787L
79	C. N. Snodgrass No. 2	(Gilmer Co.)	Jessop P. & Co	787L
80	W. C. Rollyson No. 1	(Gilmer Co.)	Enlow & Knisely	815B
81	C. N. Snodgrass No. 1	Birch	Carr & Gilmore	947L
82	J. W. Smith No. 1	Birch	South Penn	815L
83	J. W. Smith No. 1	Birch	Central Rosedale	795L
84	J. W. Twyman No. 1	Birch	South Penn	796L
85	Pauline E. Snodgrass No. 1	Birch	Mill Fork	790B
86	Schartiger No. 1	Birch	South Penn	
87	Pauline E. Snodgrass No. 2	Birch	Mill Fork	840B
88	W. G. Bennett No. 3	(Gilmer Co.)	South Penn	940B
89	W. G. Bennett No. 2	(Gilmer Co.)	South Penn	1150B
90	W. G. Bennett No. 9	(Gilmer Co.)	South Penn	1185B
91	W. G. Bennett No. 7	(Gilmer Co.)	South Penn	1110B
92	W. G. Bennett No. 8	(Gilmer Co.)	South Penn	1060B
93	W. G. Bennett No. 1	(Gilmer Co.)	South Penn	960B
94	W. G. Bennett No. 6	(Gilmer Co.)	South Penn	1145B
95	W. G. Bennett No. 5	(Gilmer Co.)	South Penn	1030B
96	W. G. Bennett No. 4	(Gilmer Co.)	South Penn	
97	W. G. Bennett No. 10	(Gilmer Co.)	South Penn	
98	Louis Bennett No. 1	(Gilmer Co.)	South Penn	825B
99	Wm. Miller No. 1	Birch	Hawkins & Ward	1005B
100	Rebecca Bourn No. 1	Birch	Pittsburgh & W. Va	795B
101	Baldwin Heirs No. 5	Birch	J. S. Carr et al	850B
102	Baldwin Heirs No. 3	Birch	J. S. Carr et al	860B
102A	Morrison No. 1	Birch	Preston Oil	880L
103	Baldwin Heirs No. 2	Birch	J. S. Carr et al	870B
104	Baldwin Heirs No. 4	Birch	J. S. Carr et al	990B
105	Baldwin Heirs No. 1	Birch	J. S. Carr et al	990B
106	Baldwin Heirs No. 6	Birch	J. S. Carr et al	1000B
106A	R. A. Young No. 2521	Birch	Hope	966L
107	S. F. Griffin No. 1	Birch	Crooked Fork	915B
108	P. M. Morris No. 1074	Birch	Hope	1025B
109	D. O. Chenoweth	(Calhoun Co.)	South Penn	880B
109A	Wm. Fisher No. 1	Holly	Crooked Fork	1090B
109B	John Adams No. 1	Holly	C. E. Bonwell	1260B
109C	J. B. Marple No. 2349	Holly	Hope	1125B
100D	A. M. Berry Heirs No. 2475	Holly	Hope	1025B
109E	Hanson C. Coger No. 1	Holly	Baker Run	930B
109F	Centralia No. 1	Holly	Stewart O. & G	953L

Wells in Braxton County, Continued.

Upper Kittanning Coal (Base)		BIG INJUN SAND (Top)		Berea Sand (Top)	Gordon Sand (Top)	5th Sand (Top)	Total Depth Feet	PRODUCING SAND AND REMARKS	No. on Map II
Depth	Elev. A. T.	Depth	Elev. B. T.						
......	......	......	......	......	......	......	......	Salt oil	62
......	......	......	......	......	......	......	......	Dry	63
......	......	......	......	......	......	......	......	Dry	64
......	......	1215	(—35)	......	1850	2040	2100	Max. and 30-ft. gas shows	65
......	......	......	......	......	......	......	......	Dry	66
......	......	1500	280	......		......	1807	Gas	67
......	......	......	......	......	......	......	......	......	67A
......	......	......	......	......	......	......	......	......	67B
......	......	......	......	......	......	......	......	......	67C
......	......	......	......	......	......	......	......	......	67D
......	......	......	......	......	......	......	......	......	67E
......	......	......	......	......	......	......	......	Good gasser in Gord. ?	67F
......	......	......	......	......	......	......	......	Dry	68
......	......	1850	1035	......	2515	2650	2920	Dry	69
......	......	......	......	......	......	......	1887	Salt oil and B. Lm. gas	69A
......	......	1875	980	......	......	......	2009	Salt and B. I. gas	70
......	......	1880	960	......	2465	2607	2612	B. Lm. gas and Salt oil	70A
......	......	1860	800	......	......	2640	2852	Dry	71
......	......	1715	930	......	......	2468	2802	Dry, B. I. oil and gas shows	71A
......	......	1825	915	......	......	......	1936	Gas in B. I., 250,000′	72
......	......	1800	1020	......	......	......	3050	Salt oil and B. Lm. gas shows	73
......	......	......	......	......	......	......	......	Dry	73A
......	......	1754	979	......	......	......	1890	Dry — Gas sand gas show	74
......	......	1685	565	1897	......	2440	2710	Gas Ss. and B. Lm. gas shows: B. I. and Berea oil shows	75
351	494	1874	1029	2148	......	2522	3861	Dry	76
166	669	1560	725	......	......	......	2725	B. I. and 5th oil shows	77
......	......	......	......	......	......	......	1547	Salt oil, 30 bbls., now 12	78
......	......	......	......	......	......	......	1533	Salt oil, 30 bbls., now 6	79
......	......	......	......	......	......	......	......	Salt oil	80
......	......	......	......	......	......	......	......	Dry	81
......	......	......	......	......	......	......	......	Salt oil	82
......	......	......	......	......	......	......	1537	Salt oil	83
......	......	......	......	......	......	......	1619	Gas Ss. gas and oil shows	84
......	......	......	......	......	......	......	1547	Gas Ss. gas and Salt oil	85
725	......	......	......	......	......	......	1549	Gas Ss. and Salt gas and oil shows	86
675	165	1786	946	......	......	......	2000	Salt oil and gas	87
......	......	......	......	......	......	......	......	Dry	88
......	......	2125	975	2420	......	2580	3275	II Cow Run gas	89
......	......	......	......	......	......	......	......	Salt oil	90
......	......	......	......	......	......	......	1783	Salt oil	91
......	......	......	......	......	......	......	1740	Salt oil show	92
......	......	......	......	......	......	......	1610	Salt oil and gas	93
......	......	......	......	......	......	......	1756	Salt oil	94
......	......	......	......	......	......	......	1778	Gas Ss. gas and Salt oil	95
......	......	......	......	......	......	......	1985	Dry	96
......	......	......	......	......	......	......	......	Dry	97
......	......	1710	885	......	(2385)	......	2668	Good gas show	98
......	......	......	......	......	......	......	1678	Salt and Gas Ss. gas show	99
......	......	......	......	......	......	......	1385	Gas Ss. and Salt gas	100
......	......	......	......	......	......	......	514	Dry; oil show	101
631	229	1954	1094	......	......	......	3093	B. Dunk. oil, Salt gas shows	102
634	246	2009	1129	......		......	3055	Dry—oil show, B. Dk., gas, Max.	102A
......	......	......	......	......	......	......	(1700)	Dry	103
......	......	......	......	......	......	......	(2500)	Dry	104
......	......	......	......	......	......	......	(2800)	Dry — gas show	105
......	......	......	......	......	......	......	(3300)	Dry	106
......	......	1800	834	......	......	......	2505	Dry	106A
......	......	......	......	......	......	......	......	Rig	107
......	......	1990	965		......	......	3204	Dry — oil show at 3110′	108
......	......	1705	825	2090	......	......	3200	B. I. gas	109
......	......	1710	620	......	......	2400	2785	Oil shows B. Lm., B. I., 4th & 5th	109A
......	......	......	......	......	......	......	(2500)	Dry	109B
175	950	1569	444	1869	......	2365	2824	Dry	109C
......	......	1240	215	......	1817	2008	2383	Dry, 5th gas and oil shows	109D
......	......	......	......	......	......	......	(2900)	Dry	109E
......	......	1060	107	......	1680	1850	3018	Dry	109F

column headed "Owner", an attempt has been made to secure the names of the present operators of the well. The following abbreviations of company names have been used in this column:

Baker Run	Baker Run Oil & Gas Company.
Benedum-Trees	Benedum-Trees Oil Company.
Central Rosedale	Central Rosedale Oil & Gas Company.
Crooked Fork	Crooked Fork Oil Company.
Eastern	Eastern Oil & Gas Company.
Gilmer O&G	Gilmer Oil & Gas Company.
Guffey	Guffey & Galey.
Hope	Hope Natural Gas Company.
Jessop, P. & Co	Jessop, Perry & Company.
Mill Fork	Mill Fork Oil & Gas Company.
Pgh. & W. Va	Pittsburgh & West Virginia Gas Company.
South Penn	South Penn Oil Company.
Stewart O&G	Stewart Oil & Gas Company.
Unity	Unity Oil Company.

Under the "Producing Sand, etc." column in the foregoing table, the following abbreviations are used for names of sands:

B. Dunk.	Big Dunkard.
Salt	Salt.
Max.	Maxton.
B. Lm	Big Lime.
Knr.	Keener.
B. I.	Big Injun.
30-ft.	Thirty-foot.
Stray	Gordon Stray.
Gord.	Gordon.
4th	Fourth.
5th	Fifth.

In addition to the abbreviated logs in the table, a large number of detailed records of wells will be given on the following pages, which give many features that it was not possible to incorporate in the table. Some of these are defective, in that many important items that should have been noted are lacking, but a number of them are very complete. The latter has enabled the writer to correct many errors of correlation by the drillers in the original record.

DETAILED WELL RECORDS, SALT LICK DISTRICT.

Salt Lick District occupies the northeastern corner of Braxton, adjoining Gilmer, Lewis, and Webster Counties, and its area is traversed in a north-south direction by two structural folds; viz, the Orlando Anticline and the Roanoke Syncline. The former fold has played a prominent part in the segregation of the present developed gas field lying between its axis and the 925-foot contour of the Pittsburgh Coal to the westward, in which the Big Injun, Gordon Stray, and Gordon Sands appear to be the chief producing zones. The following is the record of the first well drilled in this region, the well mouth being 200 feet below the horizon of the Pittsburgh Coal bed:

George Robinette No. 1 Well Record (No. 2 on Map II).

Salt Lick District, Braxton County, on Left Fork of Oil Creek, 1.4 miles northeast of Burnsville; drilled by Pittsburgh and West Virginia Gas Company; authority, Wm. H. Nicholson, Jr.; completed, April, 1901; elevation, 810′ B.

	Thickness. Feet.	Total Feet.
Conductor	18	18
Red rock	87	105
Lime	55	160
Red rock	15	175
Lime (10″ pipe, 275′)	100	275
Slate	25	300
Coal, Brush Creek?	4	304
Sand, Upper Mahoning	18	322
Slate	28	350
Lime	30	380
Slate	30	410
Lime	20	430
Sand, Upper and Lower Freeport	125	555
Lime	15	570
Coal, Upper Kittanning?	9	579
Sand	17	596
Slate	4	600
Sand	60	660
Slate	5	665
Sand, Homewood	70	735
Lime	10	745
Sand, Upper Connoquenessing	110	855
Unrecorded (8¼″ casing, 860′)	5	860
Lime	10	870
Slate	210	1080
Sand	50	1130
Slate	50	1180
Sand (slight show of oil, 1190′), Rosedale Salt	75	1255
Slate	45	1300
Lime	30	1330
Sand	40	1370
Lime	10	1380
Sand	70	1450
Red rock	40	1490
Slate (6⅝″ casing)	60	1550
Lime, Big Lime	110	1660
Sand, Big Injun	140	1800
Slate	110	1910
Lime	25	1935
Slate	185	2120
Red rock	28	2148
Sand, Stray	18	2166
Slate	4	2170
Sand, Gordon (gas)	15	2185
Slate	15	2200
Sand	6	2206
Slate	104	2310
Sand, Fifth (slight show of oil)	6	2316
Slate	314	2630

	Thickness. Feet.	Total. Feet.
Lime	10	2640
Slate	20	2660
Lime	30	2690
Slate and shells to bottom	110	2800

In the foregoing record, attention is called to the oil shows reported in the Rosedale Salt Sand and the Fifth Sand.

The three following records are from both Stray and Gordon Sand gassers, northeastward along the east hillside of Left Fork. In each, light shows of gas are reported from the Big Injun:

Mary F. Ritter No. 3811 Well Record (No. 3 on Map II).

Salt Lick District, Braxton County, on Left Fork of Oil Creek, 1.5 miles northeast of Burnsville; authority, Hope Natural Gas Company; completed, July 9, 1915; elevation, 900' B.

	Top. Feet.	Bottom. Feet.
Little Dunkard Sand	397	431
Big Dunkard Sand	466	507
Gas Sand	700	818
First Salt Sand	860	954
Second Salt Sand	1097	1172
Third Salt Sand	1245	1340
Fourth Salt Sand (show of gas at 1467', 3/10 water through 1" opening=20,000' daily)	1387	1495
Maxton Sand	1592	1646
Big Lime	1646	1701
Big Injun Sand (smell of gas at 1749', 3/10 water through ½"=5,000' daily)	1701	1854
Thirty-foot Sand	2162	2170
Gordon Stray Sand (gas at 2225', 16/10 mercury through 2" opening=700,000' daily)	2222	2240
Gordon Sand (gas at 2271', 15/10 mercury through 2" opening=680,000" daily)	2254	2275
Fourth Sand	2278	2284
Total depth		2320

10" casing, 188' (pulled); 8¼" casing, 787¾' (left in); 6⅝" casing, 1734⅝' (left in); 2" tubing, 2298' (left in). Not shot and not cemented. 8¼" packer at 868' (Steel-line measurement).

The above well starts 110 feet below the Pittsburgh Coal bed.

Belle Crutchfield No. 3812 Well Record (No. 4 on Map II).

Salt Lick District, Braxton County, on branch of Left Fork of Oil Creek, 2.8 miles northeast of Burnsville; authority, Hope Natural Gas Co.; completed, June 30, 1915; elevation, 1235' B.

	Top. Feet.	Bottom. Feet.
Big Dunkard Sand	722	764
Gas Sand	878	907
First Salt Sand, (water at 1148')	1043	1194
Second Salt Sand (gas at 1607', 6/10" water through 1" opening=29,000' daily)	1478	1852
Maxton Sand	1914	1987
Big Lime	1987	2041
Big Injun Sand, (gas at 2093', 7/10" water through 1" opening=31,000' daily)	2041	2205
No Squaw, Berea, Gantz, Fifty-foot or Thirty-foot Sands; represented only by shells		
Gordon Stray Sand (gas at 2560')	2549	2562
Gordon Sand (gas at 2591', 14/10" mercury through 2" opening=670,000' daily)	2580	2597

10" casing, 134' (111-5/6' pulled); 8¼" casing, 886⅛'; 6⅝" casing, 2091⅔'; 2" tubing, 2345 5/12'; not shot and not cemented.

The above well starts 220 feet above the horizon of the Pittsburgh Coal bed.

Martha Mick No. 3875 Well Record (No. 5 on Map II).

Salt Lick District, Braxton County, on east hillside of the Left Fork of Oil Creek, 2.8 miles northeast of Burnsville; authority, Hope Natural Gas Co.; completed, September 25, 1915; elevation 1275' B.

	Top. Feet.	Bottom. Feet.
Little Dunkard Sand	720	760
Big Dunkard Sand	840	900
First Salt Sand	1120	1390
Second Salt Sand	1432	1600
Third Salt Sand (show of gas at 1675', too small to register)	1660	1685
Maxton Sand	1956	1966
Pencil Cave	1966	1979
Big Lime	1979	1999
Big Injun Sand, (gas at 2114'; 5/10" water through 2" opening=105,000' daily)	1999	2298
Squaw Sand, broken	2359	2400
No Berea, Gantz or Fifty-foot Sands	...	....
Thirty-foot Sand	2562	2577
Gordon Stray Sand	2625	2629
Gordon Sand (gas at 2638'; 70/10" mercury through 2" opening=1,470,000' daily, from Big Injun and Gordon)	2635	2647

10" casing, 153' (pulled); 8¼" casing, 1008½'; 6⅝" casing, 2076'; 2" tubing, 2651 7/12'; not shot and not cemented.

The above well starts 285 feet above the Pittsburgh Coal bed.

The two following records are from Stray and Gordon gas wells on main Oil Creek, one of which gives the **rock pressure** of the former sand in this region as 970 pounds to the square inch:

P. S. Posey No. 3833 Well Record (No. 5A on Map II).

Salt Lick District, Braxton County, on north side of Oil Creek, 1.9 miles northeast of Burnsville; authority, Hope Natural Gas Co.; completed, June 30, 1915; elevation, 925' B.

	Top. Feet.	Bottom. Feet.
Little Dunkard Sand	370	405
Big Dunkard Sand	475	525
Gas Sand	550	650
First Salt Sand	700	800
Second Salt Sand	805	980
Third Salt Sand	1165	1520
Maxton Sand (gas at 1600', 1/10" water through 1" opening=12,000' daily)	1595	1625
Pencil Cave	1625	1645
Big Lime	1645	1700
Big Injun Sand (gas at 1760-1850', 5/10" water through 1" opening=26,000' daily)	1700	1890
No Squaw, Berea, Gantz, and Fifty-foot Sands	...	....
Thirty-foot Sand (hole reduced at 2190')	2180	2196
Gordon Stray Sand	2231	2245
Gordon Sand (gas at 2265-2273', 100/10" water through 2" opening=1,750,000' daily)	2262	2280
No Fourth Sand	...	....
Fifth Sand	2440	2450
Total depth		2522

8¼" casing, 941⅝'; 6⅝" casing, 1718⅝'; 2" tubing, 2510½'; not shot and not cemented.

The above well starts 215 above the Pittsburgh Coal bed.

E. J. Posey No. 7021 Well Record (No. 6 on Map II).

Salt Lick District, on north bank of Oil Creek, 1½ miles west of Orlando; authority, Pittsburgh and West Virginia Gas Company; completed, June 23, 1915; elevation, 825' B.

	Top. Feet.	Bottom. Feet.
Big Lime	1540	1605
Big Injun Sand	1605	1735
Gordon Stray Sand	2108	2125
Gordon Sand	2140	2155
Total depth		2202

"Gordon Stray gas 900,000 cubic feet daily, with 970 pounds to square inch rock pressure."

In the same field, the seven following records are from Gordon and Stray gas wells on Posey Run of Oil Creek:

W. T. Riffle No. 7033 Well Record (No. 7 on Map II).

Salt Lick District, on east hillside of Posey Run, 1.4 miles northwest of Orlando; authority, Pittsburgh & W. Va. Gas Co.; completed, Oct. 5, 1915; elevation, 920′ B.

	Top. Feet.	Bottom. Feet.
Maxton Sand	1278	1325
Little Lime	1535	1560
Big Lime	1590	1640
Big Injun Sand	1640	1874
Gordon Stray Sand	2232	
Total depth		2240

"2,500,000 cubic feet of gas daily with 865 pounds to square inch rock pressure in Gordon Stray."

The above well starts 115 feet below the Pittsburgh Coal bed.

R. P. Waters Heirs No. 8 Well Record (No. 8 on Map II).

Salt Lick District, Braxton County, on northeast hillside of Posey Run; 1.6 miles northwest of Orlando; authority, Snaith & Wilson; elevation, 1120′ B.

	Top. Feet.	Bottom. Feet.
Salt Sand	1000	1300
Maxton Sand (gas at 1665′)	1400	1700
Little Lime	1775	1800
Big Lime	1800	1840
Big Injun Sand	1840	2065
Gantz Sand	2160	2175
Thirty-foot Sand	2390	2420
Gordon Stray Sand (gas at 2444′)	2434	2445
Gordon Sand	2464	2495
Total depth		2675

8¼″ casing, 170′ (pulled); 6⅝″ casing, 725′; 5 3/16″ casing, 2396′; 2″ tubing, 2675′. Packer on tubing set at 2441′. 32/10″ mercury in 2″ opening,=1,000,000′ daily.

The above well starts 95 feet above the Pittsburgh Coal bed.

Thomas Conley No. 7020 Well Record (No. 9 on Map II).

Salt Lick District, on Posey Run, 1.8 miles northwest of Orlando; authority, Pittsburgh & W. Va. Gas Co.; completed, July 7, 1916; elevation, 875' B.

	Top. Feet.	Bottom. Feet.
Big Lime	1535	1565
Big Injun Sand	1565	1855
Gordon Stray Sand	2193	2204
Gordon Sand	2214	2228
Total depth		2238

"2,000,000 cubic feet of gas daily in the Gordon Stray and Gordon, mostly Gordon."

The above well stars 140 feet below the Pittsburgh Coal bed.

The three following records from wells all in Salt Lick District, Braxton County, are republished from pages 479 and 480 of the Lewis-Gilmer Report of the State Survey. Al' start above the horizon of the Pittsburgh Coal, but none reports the seam:

A. M. Donahue No. 7032 Well Record (No. 10 on Map II).

Salt Lick District, on west hillside of Posey Run, 2.4 miles northwest of Orlando; authority, Pittsburgh & W. Va. Gas Co.; completed, Oct. 14, 1915.

	Top. Feet.	Bottom. Feet.
Big Lime	2085	2208
Big Injun Sand	2208	2306
Squaw Sand	2313	2340
Gordon Stray	2708	2717
Gordon Sand	2732	2745
Total depth		2774

"500,000 cubic feet of gas daily in Gordon Stray and Gordon, mostly Gordon."

Waters Heirs No. 6 Well Record (No. 11 on Map II).

Salt Lick District, Braxton County; at head of Posey Run, 2.2 miles northwest of Orlando; authority, Snaith & Wilson; elevation, 1230' B.

	Top. Feet.	Bottom. Feet.
Big Dunkard Sand	800	880
Salt Sand	1150	1400
Salt Sand	1500	1880
Big Lime	1920	1990

	Top. Feet.	Bottom. Feet.
Big Injun Sand (gas, 2014')	1990	2240
Gordon Stray Sand (gas, 2624')	2622	2633
Gordon Sand (gas, 2663')	2651	2670
Total depth		2679

"Packer on 2" tubing set at 2059'; gas test in tubing, 95/10" mercury in 2" opening; gas test in Braden Head, 22/10" mercury in 2" opening; 6⅝" and 8" casing left in well; volume, 2,500,000 cubic feet daily."

The above well starts 285 feet above the Pittsburgh Coal horizon.

Hudson Mick Well Record (No. 12 on Map II).

Salt Lick District, Braxton County; 1.6 miles southwest of Aspinwall; authority, Hope Natural Gas Co.; completed, Jan. 5, 1914; elevation, 1265' L.

	Top. Feet.	Bottom. Feet.
Grafton Sand	520	590
Little Dunkard Sand	709	750
Big Dunkard Sand	805	850
Second Cow Run Sand	1025	1109
Salt Sand	1123	1255
Maxton Sand	1956	1986
Little Lime	1988	1995
Big Lime	1999	2029
Big Injun Sand	2029	2175
Squaw Sand	2180	2260
Gordon Stray Sand (gas, 2650')	2644	2655
Gordon Sand (gas, 2682')	2670	2698
Total depth		2699

The above well starts 315 feet above the Pittsburgh Coal bed.

Waters Heirs No. 5 Well Record (No. 13 on Map II).

Salt Lick District, Braxton County; at head of Posey Run, 2.3 miles northwest of Orlando; authority, Snaith & Wilson; elevation, 1232' L.

	Top. Feet.	Bottom. Feet.
Little Dunkard Sand	700	760
Gas Sand	1025	1340
Salt Sand	1520	1835
Little Lime	1890	1920
Big Lime	1925	1960
Big Injun Sand (gas, 1965-8'; 1985')	1960	2200
Thirty-foot Sand (gas, 2596')	2591	2600
Gordon Stray Sand (gas, 2618')	2616	2636
Total depth		2665

The above well starts 265 feet above the Pittsburgh Coal bed.

The records of the **Samuel Heater No. 3256 (No. 14 on Map II)** and **Peter Sweeny No. 7010 (No. 15 on Map II)** wells, located just across the county line in the edge of Gilmer, 0.6 mile northwest of the common corner of Gilmer, Lewis, and Braxton Counties, are published on pages 479 and 478 of the Lewis-Gilmer Report, respectively. These are Stray and Gordon Sand gassers, with shows in the Maxton and Big Injun Sands.

The following is the record of a gasser from the same field in the edge of Lewis County:

R. P. Waters Heirs No. 7 Well Record (No. 17 on Map II).

Lewis County, on waters of Threelick Run, 2.4 miles north of Orlando; authority, Snaith & Wilson.

	Top. Feet.	Bottom. Feet.
Gas Sand	745	844
First Salt Sand	1020	1060
Second Salt Sand	1200	1300
Maxton Sand (gas at 1735')	1670	1785
Little Lime	1860	1880
Big Lime	1890	1950
Big Injun Sand	1950	2150
Gantz Sand	2207	2260
Fifty-foot Sand	2275	2325
Thirty-foot Sand (gas at 2368')	2350	2380
Gordon Stray Sand (gas at 2504')	2500	2514
Gordon Sand	2527	2548
Total depth		2566

"Gas at 1735', 2368', and 2504'; all told=36/10" in 2" opening=1,050,000 cubic feet daily. 10" casing, 125' (pulled); 8¼" casing, 760'; 5 3/16" casing, 2207'; 2" tubing, 2566'. Packer on tubing set at 2368'."

The detailed log of the **R. P. Waters Heirs No. 4 Well No. 18 on Map II**—located 0.4 mile southeast of the well last given, is published in Chapter IV, page 44, in connection with the section for Orlando. It is a gas producer from the Gordon Stray Sand and is nearly on the crest of the Orlando Anticline.

The **Patrick Dolan Heirs No. 1—No. 19 on Map II**—on the crest of the latter fold, 1.6 miles northeast of Orlando, is probably a gasser from the same sand. No log was obtained for it.

In the same county (Lewis), the **J. H. Groves No. 2733 well—No. 20 on Map II**—on Oil Creek, 0.7 mile southwest of Bennett, was abandoned as a dry hole through the Fifth Sand by the Hope Natural Gas Company, but a showing of gas is reported in the Berea Sand. Its abbreviated log is given under its serial number in the table of well records for Braxton County, pages 286-7, and its more complete record on page 428 of the Lewis-Gilmer Report.

The following is the record of a light Gordon Sand gasser, ¾ mile up the east slope of the Roanoke Syncline, just across the line from Braxton County in the edge of Lewis. Its well mouth is 150 feet below the horizon of the Pittsburgh Coal bed:

G. W. Bennett No. 7018 Well Record (No. 21 on Map II).

Collins Settlement District, Lewis County, on Clover Fork, 2.7 miles southeast of Orlando; authority, Pittsburgh & W. Va. Gas Co.; completed, May 26, 1915; elevation, 900' B.

	Top. Feet.	Bottom. Feet.
Big Lime	1652	1715
Big Injun Sand	1715	1885
Squaw Sand	1920	1940
Gantz Sand	2020	2035
Gordon Sand	2150	2220
Fifth Sand	2400	2408
Bayard? Sand	2615	2635
Total depth		2760

"100,000 cubic feet of gas with 870 pounds rock pressure in Gordon Sand."

On the waters of Longshoal Run in the northwestern edge of Salt Lick District (Braxton), a small Gordon Sand oil pool was opened about 15 years ago by Guffey and Galey on the McNair farm. The two following well records, published on pages 481-2 of the Lewis-Gilmer Report, give valuable data on the oil and gas sands in this pool, the first starting about 40 feet below the Pittsburgh Coal bed, and the second, about 430 feet above the same datum, and 50 feet above the base of the Dunkard Series:

L. W. McNair Heirs No. 1 Well Record (No. 23 on Map II).

Salt Lick District, Braxton County; on Longshoal Run, 1.6 miles northeast of Gilmer Station; authority, South Penn Oil Co.; completed, about 15 years ago; elevation, 825' B.

	Top. Feet.	Bottom. Feet.
Big Dunkard Sand	533	575
Second Cow Run Sand	720	795
Salt Sand	1100	1165
Salt Sand	1200	1240
Salt Sand	1265	1360
Salt Sand	1375	1400
Salt Sand of Rosedale (gas, 1470')	1465	1505
Lime	1515	1550
Red rock	1550	1575
Lime	1600	1630
Maxton Sand	1633	1670
Big Lime	1670	1725
Big Injun Sand (gas, 1835')	1725	1945
Squaw Sand	1960	1990
Gordon (oil)	2338	2343
Total depth		2904

This was reported by residents as a 40-barrel oil well.

L. W. McNair Heirs No. 2 Well Record (No. 25 on Map II).

Glenville District, on branch of Longshoal Run, 2.1 miles southeast of Stouts Mills; authority, South Penn Oil Co.; completed in 1914; elevation, 1277' B.

	Top. Feet.	Bottom. Feet.
Sand, Waynesburg (conductor, 8')	3	50
Sand, Sewickley (little water, 285')	255	305
Sand, Lower Pittsburgh (water, 490')	450	525
Coal, Brush Creek	898	902
Sand, Burning Springs, Upper Freeport (lime and sand)	1015	1120
Sand, Second Cow Run	1215	1280
Sand, Salt	1300	1355
Lime shells and black shale	1355	1485
Sand, Salt (½ bailer of salt water per hour at 1497')	1495	1545
Lime shells and slate	1545	1685
Rosedale Salt Sand	1685	1915
Shale, black, lime shells and red rock	1915	2050
Sand, Maxton (solid lime)	2050	2070
Slate	2070	2095
Little Lime	2095	2130
Big Lime (oil and gas, 2274')	2140	2357
Sand, Big Injun	2357	2430
Shale, black, and lime shells (cave, 2700')	2430	2717
Sand, Thirty-foot	2717	2721
Sand, Gordon (gas, 2844'; oil, 2845')	2838	

10" casing, 251'; 8", 1198'.

"No figures were obtained on the production of this well, but according to residents it flowed over the derrick when completed."

The **Fred Hoover No. 1 well—No. 22 on Map II**—located 1.5 miles up Longshoal Run and 0.3 mile east of the Gilmer-Braxton Line, was a dry hole, according to Gawthrop, who was unable to obtain any definite information concerning it.

The **Wilson Heirs No. 1 well—No. 24 on Map II**—located on the east bank and 0.9 mile up Longshoal Run, according to Gawthrop, was completed by Guffey and Galey about the year 1900. On pages 441 and 481 of the Lewis-Gilmer Report, D. B. Reger reports that an oil show was found. The Survey was unable to obtain the log of this well or learn the horizon of the oil pay, but it probably occurred in either the Gordon or Salt Sand.

On March 18, 1916, the South Penn Oil Company completed a Salt Sand oil well, 0.3 mile southeast of that last described, that had an initial production of 8 barrels daily, the following log of which was kindly furnished the Survey:

L. W. McNair No. 4 Well Record (No. 23A on Map II).

Salt Lick District (Braxton), on Longshoal Run, 2¼ miles northwest of Burnsville; authority, J. A. Curry.

	Top. Feet.	Bottom. Feet.
Coal	615	619
Sand, Little Dunkard?	975	1065
Sand, Big Dunkard?	1155	1185
Gas Sand	1360	1440
Salt Sand of Rosedale	1470	
Oil pay	1618	
Total depth		1626

Since the above well was drilled after the field work in Braxton had been completed, the horizon of the well mouth is not known, but it probably starts near that of the Pittsburgh Coal bed, since the oil zone appears to be in the Salt Sand of Rosedale. The pools in the latter, as thus far developed, have been quite local in their occurrence, so that the chances are that this pool may not extend much beyond the drainage of Longshoal Run.

Westward in Gilmer County to Stouts Mills, the writer has indicated the location of wells Nos. 26 to 33 inclusive on Map II. The information on **Nos. 26, 27, 28, 29, and 31** is very meager, but the table of wells for Braxton County gives the abbreviated logs of **Nos. 30, 32, and 33.** For more detailed information concerning the latter three wells, the reader is referred to pages 89-91, 482, and 483 of the Lewis-Gilmer Report of the State Geological Survey.

The following is the record of a well in the northwestern edge of Salt Lick District, 2½ miles southwestward from the Little Kanawha River, in which a fair gas show was encountered in the Salt Sand of Rosedale. The Gordon group as also the Fifth does not appear to be represented. The well starts 95 feet below the Pittsburgh Coal bed, so that the seam at 60′ evidently correlates with the Little Clarksburg of the Conemaugh Series:

Wm. T. Brosius No. 1 Well Record (No. 34 on Map II).

Salt Lick District, on Copen Run, 0.1 mile northwest of Copen; authority, Unity Oil Company; completed, October, 1900; elevation, 835′ B.

	Top. Feet.	Bottom. Feet.
Conductor	0	28
Coal, Little Clarksburg	60	62
Sand, sharp	395	435
Sand, Big Dunkard, Lower Mahoning	515	545
Sand, Homewood, Second Cow Run	770	830
Coal, Stockton?	850	860
Sand, "Gas"?, Salt	860	960
Sand, Salt, Rosedale (gas at 1475′)	1340	1565
Slate and red rock, Pencil Cave	1672	1680
Big Lime	1680	1738
Big Injun Sand	1738	1933
Slate, pure	1933	2033
Lime shells, and slate	2033	2050
Sand, Berea, mostly slate	2050	2120
Slate and shells	2120	2185
Lime, pure	2185	2215
Slate and shells	2215	2285
Red rock	2285	2297
(Correction by steel-line measurement)		2305
Slate and shells to bottom	2305	2557½

"Small strip of shelly slate at 2328′; gas at 1475′; 10″ casing, 190′; 8¼″ casing, 962′; 6⅝″ casing, 1725′."

The **Rogers No. 1 Well—No. 34A on Map II,** on Copen, 1.3 miles southeast of the well last described, was drilled by the Hope Natural Gas Company during the latter part of 1915 and abandoned as a dry hole.

Two miles northeastward in Salt Lick District, a Gordon Sand gas pool has been opened on Hyers Run, a total of 7 wells —**Nos. 35 to 41**, inclusive, on **Map II**—having been drilled, according to Gawthrop. The following is the only record the Survey was able to obtain for any of these borings and the information in it is very meager. It starts about 135 feet below the horizon of the Pittsburgh Coal bed, so that the **oil show** reported at 1225 feet is evidently in the 'Gas" Sand of Rosedale:

W. A. Nicholson No. 2408 Well Record (No. 39 on Map II).

Salt Lick District, Braxton County, on branch of Hyers Run, 1.6 miles west of Burnsville; authority, Hope Natural Gas Co.; elevation, 830' B.

	Top. Feet.	Bottom. Feet.
Sand, "Gas", Rosedale, (show of oil at 1225').....		
Big Lime..	1645	
Sand, Gordon (reported a Gordon Sand gasser)..	2295	
Total depth..................................		2490

The **Fred Hoover No. 2 well**—**No. 42 on Map II**—located on the north bank of the Little Kanawha River, 0.4 mile northwest of the mouth of Buffalo Creek and drilled about 13 years ago by William O'Hare, according to Gawthrop, made considerable gas, or sufficient to run the boiler to complete the drilling operations, but was plugged and abandoned. The Survey was unable to learn the horizon of the gas pay, but it was probably in the Big Injun or possibly the Gordon Sand.

The **Fred Hoover No. 1 well**—**No. 43 on Map II**—located on the north bank of the Little Kanawha River, ½ mile west of the mouth of Oil Creek and drilled about 15 years ago, according to Gawthrop, by William O'Hare et al., was abandoned as a dry hole. The Survey was unable to obtain any further information concerning it.

The detailed log of the **Marshall No. 1 well**—**No. 44 on Map II**—located on the east bank of Saltlick Creek, 0.4 mile southwest of the mouth of Oil Creek, is published in connection with the Burnsville Section in Chapter IV, page 47. **Oil and gas shows** are recorded in the Rosedale Salt Sand, Big Injun, and Berea. The log of this well is also published on

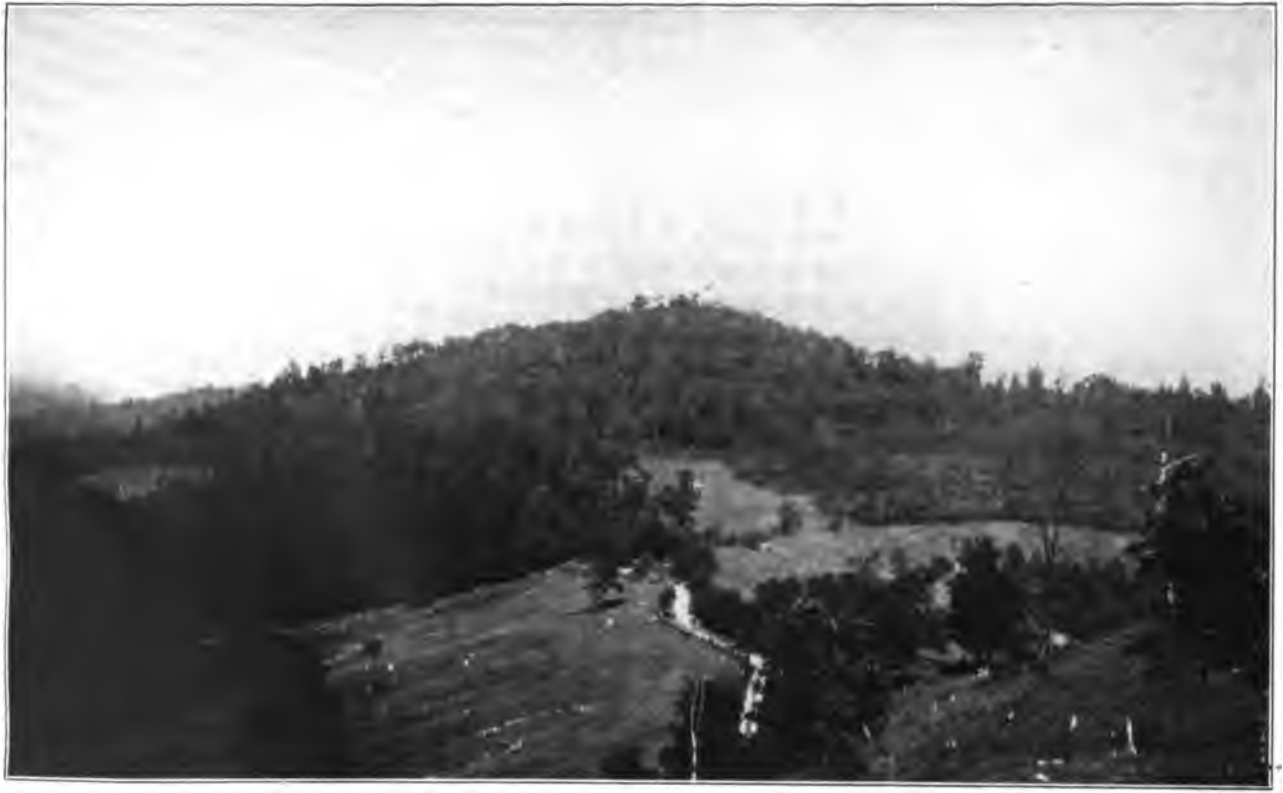

PLATE XII.—Looking N. 30° E. at Coon Knob, Braxton County; topography of Monongahela and Conemaugh Series, Pittsburgh Coal about 115 feet below summit.

page 391 of Volume I(A) of the State Geological Survey Reports.

The **William S. Hefner No. 1 well—No. 45 on Map II**—located on the north bank of a branch of Saltlick, 0.4 mile west of Burnsville, was completed in 1897 to a depth of 2640 feet, the top of the Big Injun being encountered at a depth of 1705 feet, according to Mr. C. M. Heater of the latter town. Shows of **oil and gas** were struck at probably the same zones as those reported in the well last described.

The **John I. Bender No. 1 well—No. 41A on Map II**—located on a branch of Stouts Run of Saltlick Creek, ¾ mile west of the mouth of the former stream, was drilled by the Hope Natural Gas Company, about 3 years ago, according to Mr. Bender. No log was obtained for this boring, but the gas pay was probably in the same sand (Gordon) as that in the wells on Hyers Run, just across the hill.

The **R. O. Toms No. 1 well—No. 46 on Map II**—located on the south bank of Left Fork of Saltlick, ½ mile west of Cogers (Gem P. O.) and starting 250 feet below the horizon of the Pittsburgh Coal bed, was drilled about 15 years ago by J. C. Storey et al. to a depth of only about 1200 feet, according to data furnished Gawthrop. A flow of gas was struck in probably the Salt Sand of Rosedale, but the well was finally plugged and abandoned. It did not reach the Big Lime.

The following is the record of a light Big Injun Sand gas producer on the waters of Left Fork:

R. D. Dennison No. 1 Well Record (No. 46A on Map II).

Salt Lick District, Braxton County, on branch of Left Fork of Saltlick Creek, 1.2 miles west of Cogers; drilled by Hope Natural Gas Co.; authority, John I. Bender; completed, 1915.

	Top. Feet.	Bottom. Feet.
Little Dunkard Sand	620	650
Big Dunkard Sand	675	725
Gas Sand	750	850
First Salt Sand	900	1040
Second Salt Sand	1060	1115
Third Salt Sand	1435	1755
Maxton Sand (show of gas)	1780	1790
Little Lime	1840	1855
Pencil Cave	1855	1870
Big Lime	1870	1972
Big Injun Sand (gas at 2110', 250,000' daily)	1972	2180

	Top. Feet.	Bottom. Feet.
Squaw Sand	2185	2195
Red rock at	2500	
Gordon Stray Sand	2505	2510
Gordon Sand	2543	2551
Fifth Sand	2710	2711

10" casing, 165'; 8¼" casing, 840'; 6⅝" casing, 1970'.

The following is the record of a well examined by Gawthrop on the same stream (Left Fork), in which a good showing of oil was struck in the Salt Sand of Rosedale and strong gas pays, in the latter and Gordon. The well starts about 180 feet below the horizon of the Pittsburgh Coal bed:

R. D. Dennison No. 1 Well Record (No. 47 on Map II).

Salt Lick District, Braxton County, on Left Fork, 1.6 miles southwest of Cogers (Gem P. O.); drilled by Carter, Sheets & Jarvis Co.; authority, Ben. L. Beall; completed in August, 1915; elevation, 862' L.

	Top. Feet.	Bottom. Feet.
Bakerstown Coal	190	197
Lower Mahoning Sand	375	425
Lower Kittanning Coal	620	635
Sand	705	828
"Gas" Sand, Rosedale	1190	1245
Rosedale Salt Sand (gas at 1421', oil at 1440')	1276	1463
Big Lime	1645	1734
Big Injun Sand	1734	1880
Gordon Sand (gas at 2279', 1½ million cubic feet)	2277	2286
Fifth Sand	2342	2354
Total depth		2456

10" casing, 150', left in well; 8¼" casing, 945', pulled; 6⅝" casing, 1707', left in well. Packer set at 1800'. Hole filled up to 2300'.

In a letter dated January 22, 1916, the owners give the following interesting data concerning the above well:

"In the Second Salt Sand (Rosedale), we discovered about three million cubic feet of gas. At the time we discovered this sand, our drillers had failed to put in the 8" casing and were carrying about two bailers full of water per hour. They attempted to find out how much gas was available, or in other words, to drill through the Salt Sand. At the depth of 1440 feet, they found a nice showing of oil. The well looked like it would make two or three barrels per day. In fact, it commenced to fill up slowly. Within the next two or three feet we discovered a very heavy flow of salt water. This, of course, prevented us from saving the Salt Sand gas, and as it was a test well, we cased off all the Salt Sand and drilled through to the Gordon without obtaining anything more in the form of oil or gas. At a depth of 2279 feet we discovered about one million and a half cubic feet of gas per day.

> "All sands had appearance of being good enough to produce either oil or gas. That is the sands were firm, did not appear to be broken, and the Injun Sand in particular in several places had pebbles and looked as though it was impossible to go through a sand of that kind without obtaining some pay."

The **rock pressure** of the gas in the pay at 2279 feet, which appears to be in the Gordon Sand, is reported by the owners to be 640 pounds to the square inch. They also report the bed at a depth of 620 feet to contain 20 feet of solid coal, only 15 feet being recorded in the log. The driller made a steel-line measurement when he first discovered it and also when he reached the bottom of the seam. This is evidently the Lower Kittanning seam and its extraordinary development here must be extremely local, since it is not recorded in any of the well logs previously given for Salt Lick District.

The following is the record of a dry hole located 2 miles southeast of the well last described, the elevation on which was obtained by Gawthrop. The boring starts about 300 feet below the horizon of the Pittsburgh Coal bed:

M. M. Queen No. 2351 Well Record (No. 48 on Map II).

Salt Lick District,. on bank of Burns Run, 1.9 miles south of Cogers; authority, Hope Natural Gas Co.; completed, Feb. 9, 1912; elevation, 810′ B.

	Top. Feet.	Bottom. Feet.
Sand, Upper Freeport	295	360
Upper Kittanning Coal	410	418
Sand, Upper East Lynn	418	450
Lower Kittanning Coal	503	510
Sand, Second Cow Run, Homewood (water, 520′)	515	720
Rosedale "Gas" Sand	1025	1095
Rosedale Salt Sand	1365	1460
Maxton Sand	1495	1520
Little Lime	1565	1577
Pencil Cave	1577	1590
Big Lime	1590	1644
Big Injun Sand	1644	1785
Squaw Sand	1790	1810
Thirty-foot Sand	2175	2183
Gordon Stray Sand	2197	2203
Gordon Sand	2265	2275
Fifth Sand	2463	2475
Total depth		2952

Dry hole; water at 503′ to 510′.

Casing record: 10″, 165′; 8¼″, 980′; 6⅝″, 1650′. All casing pulled and well pluggged on February 2, 1912.

The **L. D. Currence No. 1 well—No. 49 on Map II,** located in Salt Lick District, at the mouth of Benny Run, 4 miles southeast of Burnsville, was completed about 15 years ago by T. N. Barnsdale to a depth of about 2700 feet, according to Mr. Currence, who reports an **oil show** in the Gordon Sand. The Survey was unable to obtain a log of this boring, but, since it starts about 265 feet below the horizon of the Pittsburgh Coal bed, it should have penetrated below that of the Bayard or Sixth Sand. It was abandoned as a dry hole.

Three unsuccessful test wells have been sunk in the southeastern portion of Salt Lick District (Braxton). The first of these—**Samuel Cunningham No. 1—No. 50 on Map II**—located on Pigeonroost Fork, 1.6 miles southeast of Knawl, was drilled by John Farner through the Fifth Sand in 1901 and a **showing of oil** reported from the latter zone. A showing of gas was encountered, but, since no log could be obtained, the horizon of the pay could not be ascertained. The well was examined by Gawthrop, who reports the well mouth at an elevation of 920′ B., so that the boring starts about 110 feet above the Upper Kittanning Coal bed. It was abandoned as a dry hole.

The **Harvey Ware No. 1 well—No. 51 on Map II—** located on a branch of Right Fork of Falls Creek, 2.2 miles southeast of Knawl, starts at an elevation of 1015′ B., as determined by the writer, about 130 feet above the Upper Kittanning Coal seam. It is reported to have been drilled by John Farner in 1899 to a depth of about 1800 feet, or about 650 feet below the top of the Big Injun Sand—probably through the Gordon zone. Showings of oil and gas are reported by natives, but, for the same reason as with the Cunningham well, the horizon of the pays was not learned. It was abandoned as non-paying.

The detailed log of the **G. D. Walton No. 1 well—No. 52 on Map II**—located on Knawl Creek, 1 mile northwest of the summit of High Knob, and examined by Gawthrop, is published in Chapter IV, page 49, in connection with the Head of Knawl Creek Section. Only a slight **trace of oil and gas** was found—near the base of the upper division of the Big Lime—

although the boring penetrated 241 feet below the Bayard or Sixth Sand.

The **E. G. Davidson No. 1 well—No. 53 on Map II—** located in Lewis County, 0.7 mile northeast of Walkersville, made about 100,000 cubic feet of gas daily, according to Reger[6], most of which was from the Big Injun Sand, the Gordon having only a small amount. A showing of oil and salt water was also struck in the former zone. The **rock pressure** of the gas (probably including the Gordon pay) was 700 pounds to the square inch.

Just across the line from Salt Lick District (Braxton) in the southern panhandle of Lewis County and in the immediately adjoining portions of Upshur and Webster, good **showings of oil and gas** have been found in nearly every one of the 14 wells that have been completed in this region, all of which—**Nos. 54 to 67 on Map II**—are listed in the table of wells for Braxton County, pages 286-9, to which the reader is referred for abbreviated data as republished from pages 202-3 of the Lewis-Gilmer Report last referenced. The oil and gas zones belong near the base of the Pottsville Series in what appear to be divisions of the Salt Sand of Rosedale. On page 375 of Volume I(a) of the State Survey Reports, I. C. White gives the following account on the occurrence of the oil in this locality:

> "The oil is of light gravity and amber color but is so mixed up with water that no paying wells have ever been found, although a fine 'showing' has been obtained in nearly every one of the dozen or more wells that have been drilled. It appears to be impossible to case off the water without also shutting off the oil."

D. B. Reger gives a brief description of this field on pages 431-2 of the Lewis-Gilmer Report above mentioned. The detailed logs of wells **Nos. 56 and 67 on Map II** are given in Chapter IV of this volume in connection with the sections for Bablin and Cleveland, pages 51 and 58, respectively. The following is the detailed record of another that is located about midway between the two wells last mentioned, as republished from page 432 of the Lewis-Gilmer Report. According to results obtained by Reger on page 584 of the Report last mentioned, this boring starts 225 feet below the Lower Kittanning Coal bed:

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[6] D. B. Reger, Lewis-Gilmer Report, W. Va. Geol. Survey, p. 430; 1916.

J. W. Lake No. 1 Well Record (No. 65 on Map II).

Collins Settlement District, on Hacker Camp Run, 1.6 miles southeast of Bablin; elevation, 1250' B.

	Thickness. Feet.	Total. Feet.
8¼" casing to rock	40	40
Slate and shell	360	400
Sandy lime (6⅝" casing, 576')	176	576
Sandy lime, red rock, shale, and slate (little gas, 900')	324	900
Unrecorded	70	970
Maxton Sand		
Pencil Cave	10	980
Big Lime, very white	220	1200
Red rock	15	1215
Sand, Big Injun	185	1400
Sandy lime, red rock	125	1525
White slate with lime shells	175	1700
Sand, hard, close, Thirty-foot (little gas)	20	1720
Slate and shale	95	1815
Hard sand, Gordon Stray	5	1820
Shale	30	1850
Gray sand, Gordon	15	1865
Black shale	20	1885
Sandy lime, Fourth	45	1930
Shale	40	1970
Lime	15	1985
Shale and sandy shells	55	2040
Sandy lime, Fifth	10	2050
Shale	50	2100

PROSPECTIVE OIL AND GAS AREAS, SALT LICK DISTRICT.

In Salt Lick District, Braxton County, the drilling operations have been mostly confined to the northwestern slope of the Orlando Anticline, and there remain large areas within its borders that are practically untouched by the drill that have more or less favorable conditions as regards both structure and development associated with them. These will now be described from northwest to southeast. (1) In the view of the Gordon Sand oil showing in wells Nos. 23, 24, and 25 on Map II in the northwestern edge of the District on the waters of Longshoal Run, and the row of dry holes—Nos. 27, 26 and 28 on Map II—in the edge of Gilmer County, immediately on the west, the chances are that, if the pool has any size, it may extend southwestward closely along the west side of the 900-foot contour of the Pittsburgh Coal as it is outlined on Map II. (2) That region included in the upper portion of the drainage basin of Buffalo Creek, appears favorable for gas in the Gordon Sand, as also in the Big Injun and Stray, with a remote chance for oil in the Rosedale Salt Sand. (3) That included in the drainage basin of Left Fork of Saltlick Creek, above well No. 46 on Map II, for gas in the Rosedale Salt Sand, Big Injun, and the Gordon, owing to its comparatively high structural level and the results obtained in wells Nos. 46A and 47 on Map II in the immediate locality, with a chance for oil in the Salt of Rosedale. (4) That along the crest of the Orlando Anticline is specially favored from a structural standpoint for gas in the Big Injun, Stray and Gordon, with the chances probably more in favor of that lying northeastward from the head of Shreve Run, in view of the present gas development on the north side of Oil Creek. (5) That, northeastward from the Little Kanawha River to the Lewis County Line and lying between the 1000- and 1200-foot contours of the Upper Kittanning Coal as these are outlined on Map II, appears favorable for oil and gas, due to the marked structural terrace prevailing between rapid northwest dips of the rocks. (6) That portion of Salt Lick District immediately surrounding Wildcat appears favorably located for oil in the same sand (Rosedale Salt Sand?) as that in which the oil was found in the wells in the southern panhandle of Lewis, described on a preceding page, should the field in question have a southwest extension. In a test well located on the river bottoms just below Wildcat, this sand should be encountered at a depth of 300 to 350 feet and the Big Injun, at 1000 to 1100 feet. (7) In the southwest corner of Salt Lick District, attention is called to the structural terrace outlined on Map II by the divergence of the 625- and 650-foot contours of the Upper Kittanning Coal between Corley and Flatwoods, a feature that is favorable for segregating any oil the sands might contain into a commercial pool on this bench. In this region, what appears to be the Gordon Sand is good, pebbly and 57 feet in thickness as shown by the log of the J. B. **Marple well**—

No. 109C on Map II—1.5 miles southeast of Corley. So that any test on the terrace in question should be drilled through the latter sand, as also the Fifth, ever keeping in mind that the function of the geologist in suggesting favorable areas to drill for oil and gas is to largely eliminate many of the chances of failure in a more or less hazardous undertaking from a financial standpoint; that the conclusions reached are the result of a careful study of all the available data based on the structural and reservoir conditions associated with the development of the petroleum and natural gas industry from its beginning; and that the drill is always the final test. The latter is specially true in the territory of this Report where no oil seepages occur.

DETAILED WELL RECORDS, OTTER DISTRICT (BRAXTON).

Otter District extends in a northwest-southeast direction entirely across the middle of Braxton County, the Pittsburgh Coal horizon ranging from about 800 feet above sea-level near Waldeck on the Gilmer-Braxton Line to 2440 feet above the same datum in the extreme southeastern point of the District. This long southeast rise of the strata is interrupted by four slight structural folds as shown on Map II; viz, the Sleith Fork and Gassaway Anticlines, and the Tague Fork and Gassaway Synclines. Ten widely scattered wells have been drilled within the borders of Otter for oil and gas, all of which were non-paying with the possible exception of three. The two following records are from wells in the northwest border of the District:

A. L. Jack No. 1 Well Record (No. 69 on Map II).

Otter District, on east bank of Cedar Creek, 2.4 miles northwest of Cutlips; authority, South Penn Oil Company; completed May 4, 1901; elevation, 815' B.

	Top. Feet.	Bottom. Feet.
Sand, "Minshall," Connellsville	31	45
Sand, Second Cow Run, (Homewood)	875	940
Sand, white, Salt	1110	1130
Sand, white, Salt	1160	1264
Sand, Gas, Rosedale	1317	1342
Sand, Salt, Rosedale	1545	1585

	Top. Feet.	Bottom. Feet.
Pencil Cave	1788	1800
Big Lime	1800	1850
Sand, Big Injun	1850	2000
Sand, Gordon	2515	2520
Sand, Fifth	2650	2665
Total depth		2920

10″ casing, 260′; 8″ casing 960′; 6⅝″ casing, 1600′; abandoned Sept. 27, 1902.

The above well, examined by Gawthrop, starts about 85 feet below the horizon of the Pittsburgh Coal bed, and 5 feet below the base of the Lower Pittsburgh Sandstone. It was abandoned as a dry hole.

H. B. Gerwig No. 1 Well Record (No. 70 on Map II).

Otter District, Braxton County; on Toms Run, 1.0 mile southeast of Hope; authority, Ash Brothers; completed in 1914; elevation, 895′ L.

	Top. Feet.	Bottom. Feet.
Sand, Little Dunkard	455	475
Sand, Burning Springs, Upper Freeport	600	690
Sand, "Gas"	740	845
Sand, Second Cow Run and Salt	855	980
Sand, Salt	1185	1250
Sand, Salt	1345	1355
Sand, Salt (water, 1370′)	1355	1385
Sand, Salt, "Rosedale Gas"	1430	1495
Sand, Rosedale (gas, 1537′)	1535	1546
Sand, Salt	1561	1632
Big Lime	1830	1875
Sand, Big Injun (gas, 1960′)	1875	1995
Total depth		2009

"10″ casing, 300′; 6⅝″ casing, 1400′; 2″ tubing, 2009′; volume, 500,000 cu. ft, daily, approximately."

The above well, examined by Gawthrop, starts 55 feet below the horizon of the Pittsburgh Coal bed, and its record, with slight additions, is as published on page 485 of the Lewis-Gilmer Report of the State Geological Survey.

The following is the record of a well drilled during 1915 in the same portion of Otter District just below the point that the axis of the Sleith Fork Anticline intersects with Crooked Fork. An initial flow of one-half million cubic feet of gas daily was struck in the Salt Sand, and one-fourth million from the

Big Injun when tools were lost. It was examined by Gawthrop and starts 25 feet below the horizon of the Pittsburgh Coal bed:

James J. Stalnaker No. 1 Well (No. 72 on Map II).

Otter District, Braxton County; on Crooked Fork, just east of Progress; by Crooked Fork Oil Co.; authority, Earl Fox; completed in the Fall of 1915; elevation 910′ B.

	Top. Feet.	Bottom. Feet.
Sand, Burning Springs (Upper Freeport), (show of oil at 640′)	620	672
Sand, "Gas"	760	780
Sand	790	815
Sand, Second Cow Run, (Homewood)	850	975
Sand	1040	1080
Sand, Salt (½ million cu. ft. gas daily at 1236′)	1230	1280
Sand	1360	1440
Sand, Rosedale Gas	1500	1560
Sand, Rosedale Salt	1590	1655
Sand, Maxton	1710	1758
Big Lime	1790	1825
Sand, Big Injun (gas at 1936′)	1825	1936

The tools were lost at 1936 feet, and after fishing a long time the well was finally abandoned.

The following is the record of a well, examined by Gawthrop, that starts about 230 feet below the horizon of the Pittsburgh Coal bed. Only a light pay of gas—20,000 cubic feet daily—was found, according to the owners, and this occurred in the Burning Springs (Upper Freeport) Sand:

J. G. Perrine No. 2350 Well Record (No. 71 on Map II).

Otter District, Braxton County; on Grasslick Run, 0.8 mile N. 15° E. of Sugar Knob, and 3 miles northwest of Gassaway; authority, Hope Natural Gas Company; completed, February 16, 1912; elevation, 1060′ B.

	Top. Feet.	Bottom. Feet.
Sand, Burning Springs (Upper Freeport), (gas at 415′; 3/10 water through 1″ opening, 20,000 cu. ft.)	397	470
Sand, Second Cow Run	598	630
Sand, First Salt	750	800
Sand, Gas, Second Cow Run	598	630
Sand, Maxton	1470	1700
Big Lime	1805	1860
Sand, Big Injun	1860	2015

	Top. Feet.	Bottom. Feet.
Sand, Squaw	2108	2130
No Gantz, Fifty-foot, Thirty-foot, Gordon Stray, Gordon, or Fourth Sands.		
Sand, Fifth, limy sheets, (smell of gas at 2640')	2640	2645

13" casing: put in well, 85'; left in well, 38⅛'; 10" casing: put in well, 127⅜'; left in well, 52⅛'; 8¼" casing: put in well, 944'.

The following is the record of a well, examined by Gawthrop, in the northwest corner of Otter District, that starts about 175 feet below the horizon of the Pittsburgh Coal bed. It was drilled 16 feet below the base of the Big Injun Sand. and only shows of gas found in what appears to be the Rosedale Gas Sand, and in the Big Injun as also an oil show in the Rosedale Salt Sand. It was abandoned as a dry hole:

A. Mayer No. 1 Well Record (No. 74 on Map II).

Otter District, Braxton County, on O'Brien Fork, 1.9 miles northeast of Rosedale; authority, John McCoy et al.; completed, December 12, 1914; elevation, 775' B.

	Thickness. Feet.	Total Feet.
Gravel	41	41
Lime	159	200
Slate	30	230
Sand, Saltsburg (water at 250')	20	250
Slate	60	310
Sand, Buffalo	50	360
Slate	126	486
Sand, Upper Freeport	74	560
Slate	60	620
Sand, Upper East Lynn	75	695
Slate	15	710
Coal, Lower Kittanning	3	713
Slate	2	715
Sand, Homewood	115	830
Slate	35	865
Coal, Stockton?	3	868
Lime	115	983
Sand	22	1005
Slate	125	1130
Sand	35	1165
Slate	82	1247
Sand, Rosedale "Gas" (show of gas at 1248')	25	1272
Coal, Sewell?	2	1274
Slate	14	1288
Sand	45	1333
Slate	107	1440
Sand	33	1473
Slate	77	1550

	Thickness. Feet.	Total. Feet.
Sand, Rosedale Salt, (oil show at 1590')	70	1620
Slate	20	1640
Red rock	5	1645
Slate	10	1655
Lime	30	1685
Pencil Cave	9	1694
Big Lime	60	1754
Sand, Big Injun (gas at 1861'-1869')	120	1874
Slate to bottom	16	1890

13" casing, 41'; 10" casing, 147'; 8¼" casing, 770'.

The following is the record of a well located 1 mile westward in the edge of Gilmer County that starts 85 feet below the horizon of the Pittsburgh Coal bed, and is republished from page 492 of the Lewis-Gilmer Report. It is very interesting and important, in that it shows the complete absence of Devonian sands to a depth of 1250 feet below the top of the Big Injun, a feature that should be considered carefully before drilling on below the latter sand in this region:

T. V. Shock No. 1 Well Record (No. 73 on Map II).

Center District, Gilmer County, on Road Run, 1.3 miles north of Rosedale; authority, South Penn Oil Co.; completed in 1914; elevation, 780' B.

	Top. Feet.	Bottom. Feet.
Coal, Upper Freeport	485	486
Sand, Gas, Rosedale	1318	1390
Sand, Salt, Rosedale (oil show, 1533'; water in bottom)	1490	1538
Sand, Maxton	1570	1590
Little Lime (oil show, 1720')	1670	1736
Big Lime (gas, 1790')	1736	1800
Sand, Big Injun	1800	1896
Lime, shell and slate to bottom	1896	3050

10" casing, 156'; 8¼" casing, 481'.

The above well was abandoned as a dry hole.

Southeastward in Otter District (Braxton), a practically dry hole was drilled by the Hope Natural Gas Company high up on the western slope of the Gassaway Anticline. The well was examined by Gawthrop and starts about 300 feet below the horizon of the Pittsburgh Coal bed. The following record of it reveals the absence of all the Catskill sands, with the exception of the Fifth and it is only 5 feet in thickness. Oil shows occur in the Big Injun and Berea:

Silas Carr No. 2617 Well Record (No. 75 on Map II).

Otter District, Braxton County, on head of Plantation Fork, 1.3 miles southwest of Clickton; authority, Hope Natural Gas Company; completed, December 31, 1912; elevation, 1120′ B.

	Top. Feet.	Bottom. Feet.
Sand, Little Dunkard	165	290
Sand, Burning Springs (Upper Freeport)	345	395
Sand, Second Cow Run, (gas at 525′; 10/10 water through 1″ opening, or 38,000 cu. ft. daily)	445	550
Sand, Rosedale "Gas"	1175	1340
Sand, Rosedale Salt	1410	1525
No Maxton Sand.		
Pencil Cave	1582	1589
Big Lime, (gas at 1648′; 6/10 water through 1″ opening, or 29,000 cu. ft. daily)	1590	1685
Sand, Big Injun, (oil at 1700′; made 1½ bailers in 4 hours; then exhausted)	1685	1815
No Squaw Sand.		
Sand, Berea, (oil show at 1904′)	1897	1911
No Gantz, Fifty-foot, Thirty-foot, Gordon Stray, Gordon, and Fourth Sands.		
Sand, Fifth	2440	2445
Total depth		2710

10″ casing; put in well, 288′; left in well, none.
8¼″ casing; put in well, 882′; left in well, none.
6⅝″ casing; put in well, 2313′; left in well, 359′.
"This well is plugged and will be abandoned—not cemented."

The following is the record of a well 4 to 5 miles northeastward in the same District, the data on which was kindly furnished the Survey by Ben L. Beall of Burnsville, Braxton County:

J. C. Gerwig No. 1 Well Record (No. 70A on Map II).

Otter District (Braxton), on Left Fork of Steer Creek, 0.8 mile northwest of Chapel; by Eastern Oil & Gas Co.; completed in May, 1916; elevation, about 920′.

	Top. Feet.	Bottom. Feet.
Sand, Little Dunkard	290	315
Sand, Big Dunkard, (small gas show at 372′)	370	430
Sand, Burning Springs, (small gas show at 455′)	450	459
Sand, First Salt, (hole full of water at 690′)	680	790
Sand, Second Salt	1100	1130
Sand, "Gas," Rosedale	1240	1245

	Top. Feet.	Bottom. Feet.
Sand, Salt, Rosedale (gas at 1403' and 1406'; oil and water pay, 1406'-1412'; oil. 1483'-1493')	1392	1507
Sand, Maxton	1620	1697
Little Lime	1715	1747
Pencil Cave	1760	1775
Big Lime (big gas pay at 1875')	1775	1875
Sand, Big Injun	1880	1995
Slate and shells	2000	2465
Sand, Gordon	2465	2470
Slate and shells	2470	2607
Sand, Fifth, to bottom of hole	2607	2612

"Tools were blown 400 feet above top of derrick at 1875 feet or the bottom of the Big Lime. Quantity of gas unknown, but was supposed to be from 30 to 40 million cubic feet daily which lasted only a few hours at this rate.

"Two strings of tubing are now in well, one of which is to the Salt Sand oil and the other to the top of the Injun to take care of the gas, which has been reduced now (July 6, 1916) to about one and a half million cubic feet daily."

The above well starts about 200 feet below the horizon of the Pittsburgh Coal and it is located in the northwest portion of the slight structural terrace indicated on Map II by the wide divergence of the 1100- and 1200-foot contours of the Pittsburgh Coal northeastward from the head of Triplett Fork of O'Brien Creek. As regards its gas production, the big pay occurs apparently in the base of the Big Lime, the well being more or less of a "freak", since, according to Mr. Beall, it was making only 1½ million cubic feet daily on July 6, 1916. According to D. J. Carter of Clarksburg, W. Va., it had a 60-barrel showing of oil in the Salt Sand when the pay was first encountered, but this fell off rapidly and the well was then drilled on down to the lower zone. Oil evidently occurred in the Salt Sand in amount sufficient to cause a serious attempt to save it, since a special string of tubing was put in the well for this purpose as shown in the above record and data. The sands of the Catskill Series are represented only by the Gordon and Fifth and these are only 5 feet in thickness.

Shock Heirs No. 1 Well Record (No. 69 on Map II).

Otter District (Braxton), on head of Little Trace Run of Cedar Creek, about 3 miles west of Exchange on the Coal & Coke R. R.; completed in July, 1916, by Hoffmeier & Digman, Contractors for Victoria Oil & Gas Co.; elevation, about 1030′ B.; authority, J. F. Spires.

	Top. Feet.	Bottom. Feet.
Sand, Big Dunkard	430	475
Sand, Gas	585	630
Sand	640	720
Sand	735	790
First Gas Sand	900	975
Coal	995	1000
Second Gas Sand	1050	1090
First Salt Sand, (17/10 water in 1″; gas test)	1180	1225
Second Salt Sand	1365	1400
Third Salt Sand	1465	1516
Rosedale Sand (show of oil, 1576′)	1518	1585
Coal	1540	1541
First Maxton Sand	1656	1695
Second Maxton Sand	1730	1762
Little Lime	1795	1818
Pencil Cave	1844	1854
Big Lime	1854	
Gas, 1860′, 1880′, and 1885′ (98/10 mercury in 2″)		
Total depth		1887

10″ casing, 176′; 8¼″ casing, 902′; 6⅝″ casing, 1920′.

1st minute pressure, 40 pounds.
2nd minute pressure, 70 pounds.
3rd minute pressure, 110 pounds.
4th minute pressure, 140 pounds.
5th minute pressure, 170 pounds.
6th minute pressure, 190 pounds.
7th minute pressure, 210 pounds.
8th minute pressure, 230 pounds.
9th minute pressure, 245 pounds.
10th minute pressure, 255 pounds
30th minute pressure, 425 pounds.
60th minute pressure, 545 pounds.
4 hours pressure, 630 pounds.
16 hours pressure, 650 pounds.

The above well was completed in July, 1916, after the Chapter on Oil and Gas was finished, so that its location was not visited in the field, but it is reported as starting about 80 feet below the Pittsburgh Coal bed. The mercury-gauge test for the volume of gas encountered in the Big Lime is equivalent to about 1,740,000 cubic feet daily. The **oil show** at 1576 feet is in the **Rosedale Salt Sand,** or at the same horizon as that was found in Wells Nos. 47, 70A and 76 on Map II.

Fred Depoy No. 1 Well Record (No. 76 on Map II).

Otter District, Braxton County, just east of mouth of Walnut Fork of Little Otter Creek, 1.4 miles northeast of Gassaway; authority Benedum & Trees Oil Co.; completed, March 10, 1914; elevation, 845' B.

	Thickness. Feet.	Total. Feet.
Unrecorded	29	29
Red rock	6	35
Hard boulder	12	47
Slate	27	74
Sand, Lower Mahoning	86	160
Slate	33	193
Lime	27	220
Sand	29	249
Coal, Lower Freeport	3	252
Slate	96	348
Coal, Upper Kittanning	3	351
Sand	44	395
Coal, Lower Kittanning	3	398
Sand, Second Cow Run (Homewood)	170	568
Slate and shells	134	702
Sand	82	784
Slate	9	793
Sand	7	800
Lime	20	820
Sand	25	845
Slate	55	900
Lime, black	54	954
Sand	46	1000
Slate	52	1052
Sand, Rosedale "Gas"	170	1222
Slate	18	1240
Lime, black	7	1247
Sand, white, Rosedale Salt (little salt water at 1412'; little gas at 1426'; and little oil at 1428')	210	1457
Red rock	62	1519
Lime	24	1543
Shells	20	1563
Slate, black	13	1576
Lime	38	1614
Slate	7	1621
Sand, Maxton	16	1637
Slate	10	1647
Big Lime	227	1874
Shells	78	1952
Slate	18	1970
Shells	178	2148
Sand, Berea	9	2157
Shells	185	2342
Sand, Gordon Stray	3	2345
Slate	83	2428
Lime	70	2498
Slate	24	2522
Lime	8	2530

	Thickness. Feet.	Total. Feet.
Slate and shells	**270**	**2800**
Lime, hard	**35**	**2835**
Slate	**15**	**2850**
Lime	**456**	**3306**
Slate and shells	**555**	**3861**

10" casing, 180'; 8" casing, 931'; 6" casing, 2100'.

The above well starts 410 to 420 feet below the horizon of the Pittsburgh Coal bed and it penetrates almost 2000 feet below the base of the Greenbrier Limestone (Big Lime). The sands below the Berea are almost entirely absent, only 3 feet of what appears to be the Gordon Stray being represented. The oil and gas shows recorded are evidently in the Salt Sand of Rosedale.

The detailed log of the **Haymond No. 1 Well—No. 77 on Map II**—located in the eastern border of Otter District (Braxton) on the north bank of Elk River, 100 to 150 feet above the mouth of Buffalo Creek, is published in Chapter III in connection with section for Sutton, pages 94-5. Slight **oil shows** were encountered in the Big Injun and Fifth Sands.

PROSPECTIVE OIL AND GAS AREAS, OTTER DISTRICT (BRAXTON).

A careful study of the foregoing records and data on the test wells completed in Otter District shows that there is a considerable area in the latter that appears barren of oil and gas in commercial quantities and that there are other regions within its borders so favored by either structure or development or both, that the drilling of additional test wells is warranted. (1) In the western point of the District, that region lying along the crest of the Sleith Fork Anticline southwestward from the head of Toms Run of Cedar Creek to the Otter-Birch District Line appears favorable for both Salt and Big Injun gas, in view of the results found in **Wells Nos. 70, 72 and 74 on Map II,** listed in the Braxton County Table of Well Records and described on preceding pages of this Chapter. (2) That area, with a width of 2 to 3 miles, extending northeastward from Chapel to the Otter-Salt Lick District Line in the vicinity of Delta appears favorable for oil in the Salt Sand of Rosedale, in view of the shows encountered in this sand at the **Dennison and Gerwig wells—Nos. 47 and 70A on Map II,** respectively, as also at No. 76, 1.4 miles northeast of Gassaway, in addition to an excellent chance for gas in paying quantities in the Big Lime, Big Injun, and Gordon. (3) That region along the crest of the Gassaway Anticline and mostly included in the drainage basins of Sugarcamp and Rockcamp Runs and Coon Creek and the head of Mill Creek, is ideally located for gas from a purely structural standpoint, say in the Big Injun and Salt Sands, since those below the former are probably absent, in view of the results obtained at **Wells Nos. 71, 75, and 76 on Map II.** (4) The comparatively high structural level occupied by the southeastern point of Otter District favors this region to that extent for gas in the Big Injun and Salt Sands. A test well for this locality near the mouth of Laurel Run of Little Birch River should reach the former sand at about 1800 feet below the horizon of the Upper Kittanning Coal—an estimate on the basis of the intervals existing at Centralia and Widen—or at a depth of about 1600 feet.

DETAILED WELL RECORDS IN BIRCH DISTRICT (BRAXTON COUNTY).

Birch District occupies the southwest portion of Braxton County in a region where the lay of the strata is very much warped and twisted, its area, as shown in detail on Map II, being traversed by the Sleith Fork and Gassaway Anticlines, and the Grassland and Tague Fork Synclines. Southeastward from the axis of the latter Basin, however, the structural conditions are much more regular. A total of 20 wells have been drilled within the District, of which 5 are oil producers; 2, gas; and 13, dry holes.

The Rosedale Oil Field

The Rosedale Oil Field, located partly in the extreme northwest edge of Birch District and mostly just across the Braxton Line in the edge of Gilmer County, consists, as at present developed, of two distinct pools, both of which obtain their production from the Rosedale Salt Sand. The first is located on the head of Anthony Fork, just in the edge of Gilmer, 2 miles southwest of Rosedale, and was opened on the W. G. Bennett farm by the South Penn Oil Company 13 to 15 years ago. This pool will be described further on subsequent pages. The second is located in the town of Rosedale, partly in Gilmer and partly in Braxton County, and was opened by independent operators within the last 3 or 4 years. In it the oil is usually found in the lowest sandstone member of the Pottsville Series in this region or the **Rosedale Salt Sand,** described on previous pages of this Chapter. On September 7, 1915, a total of 29 wells had been drilled in this pool, of which 23 produced oil; 1, gas; and 5 were dry holes, the total production of the pool for the month of August, 1915, being 1300 barrels, according to C. B. Beatty of the South Penn Oil Company. The largest initial daily producer did not exceed 50 barrels. The **Rosedale Gas Sand,** also described on preceding pages of this Chapter, is an important gas zone. On pages 491-4 of the Lewis-Gilmer Report of the State Geological Survey, D. B. Reger gives the logs of 6 wells from this pool to which reference is made for details. The three following records are from wells in the Rosedale pool:

C. N. Snodgrass No. 1 Well Record (No. 78 on Map II).

Center District, Gilmer County, on west bank of Right Fork, in Rosedale; authority, Jessop, Perry & Co.; completed, April 25, 1915; elevation, 787' L.

	Top. Feet.	Bottom. Feet.
Sand, Upper Freeport	470	536
Sand, Lower Freeport	565	586
Sand, East Lynn	690	715
Coal, Lower Kittanning	715	720
Coal, Clarion	735	740
Sand, Homewood	748	795
Slate and shells	795	1195
Sand	1195	1288
Sand, Rosedale Gas	1360	1453
Sand, Rosedale Salt	1500	....

"1st gas at 1385'; 2nd gas and 5 bbl. show of oil at 1416'; oil at 1521' to 1547'; pay very soft; 10" casing, 167'; 8¼" casing, 776'; 6⅝" casing, 1506' 2".

The above well flowed oil through the casing from the pay in the Gas Sand after the well was more than a week old. The initial production was 30 barrels daily; now 12 barrels daily from the Salt Sand. It starts 150 feet below the horizon of the Pittsburgh Coal bed, as determined by the writer.

C. N. Snodgrass No. 2 Well Record (No. 79 on Map II).

Birch District, on west side of Right Fork in Rosedale; authority, R. C. Perry; completed summer of 1915; elevation, 787' L.

	Top. Feet.	Bottom. Feet.
Coal, Upper Kittanning	620	625
Coal, Lower Kittanning	700	705
Coal, Clarion	720	725
Sand, Salt	1195	1275
Sand, Rosedale Gas	1355	1435
Sand, Rosedale Salt	1486	....
Oil	1510	1527
Total depth		1533

"Initial production, 30 barrels daily; now making 5 to 6 barrels daily; 12½" casing, 32'; 10" casing, 143'; 8" casing, 762'; 3 bailers of water at 210'."

The above well starts 160 feet below the horizon of the Pittsburgh Coal bed, as determined by the writer.

Schartiger No. 1 Well Record (No. 86 on Map II).

Birch District, on east side of Right Fork in Rosedale; authority South Penn Oil Company; completed, 1914.

	Top. Feet.	Bottom. Feet.
Slate and shells	16	240
Sand	240	255
Slate and shells	255	360
Sand (water at 380')	360	383
Slate and shells	383	475
Sand, limy, Upper and Lower Mahoning	475	550
Slate	550	560
Sand, Upper Freeport (water)	560	605
Slate and shells	605	695
Sand, Lower Freeport	695	722
Coal, Lower Kittanning	722	725
Slate	725	750
Coal, Clarion	750	755
Slate	755	780
Sand, Homewood	780	820
Slate and shells	820	1223
Sand, Salt (oil show at 1240')	1223	1323
Slate and shells	1323	1410

	Top. Feet.	Bottom. Feet.
Sand	1410	1438
Slate	1438	1440
Sand, Rosedale Gas	1440	1460
Slate	1460	1525
Sand, Salt (gas at 1534'; oil at 1538')	1525	1540
Slate to bottom	1540	1549

"Abandoned as dry hole. Conductor, 16'; 8¼" casing, 575'; 6⅝" casing, 1528'."

The above well starts about 70 feet below the Pittsburgh Coal bed.

The three following records of wells in the Rosedale pool—all on the Braxton side of the County Line—contain much data of interest, and, with the exception of some slight changes and additions in correlation, are as published on pages 493, 493, and 494 respectively of the Lewis-Gilmer Report above mentioned:

J. W. Smith No. 1 Well Record (No. 83 on Map II).

Birch District, Braxton County; on Steer Creek, at Rosedale; authority, Central Rosedale Oil and Gas Co.; completed in 1914; elevation, 795' L.

	Top. Feet.	Bottom. Feet.
Salt Sand (gas, 1400-10' and 1425-7')	1370	1430
Salt Sand	1432	1445
Lime (gas, 1495')	1478	1520
Rosedale Salt Sand (oil, 1525') to bottom (still in sand)	1520	1537

10" casing, 20'; 10" casing, 151'; 8¼" casing, 533'; 6⅝" casing, 1179'; 5$\frac{3}{16}$" casing, 1537'; 10-bbl. well.

Pauline E. Snodgrass No. 1 Well Record (No. 85 on Map II).

Birch District, Braxton County, on Mill Fork, 0.2 mile southeast of Rosedale; authority, Mill Fork Oil & Gas Co.; elevation, 790' B.

	Top. Feet.	Bottom. Feet.
Sand, Moundsville, Saltsburg	215	245
Sand, Little Dunkard	325	360
Sand, Burning Springs, Upper Freeport (water, 430'; gas, 541')	415	530
Sand, Gas	593	600
Sand, Second Cow Run, Homewood	658	710
Sand, Salt (gas, 1205-26')		1275
Sand, Salt (gas, 1386' and 1418')	1376	1428

	Top. Feet.	Bottom. Feet.
Sand, Salt	1474	1485
Sand	1495	1515
Sand, Rosedale Salt (gas, 1525'; oil, 1527')	1520	1534
Slate to bottom	1539	1547

10" casing, 185'; 8¼" casing, 658'; 6" casing, 1474'; 5- to 6-bbl. well.

"Besides the oil, the above well had an estimated gas volume of 3,000,000 cu. ft. daily, from which the town of Rosedale is supplied."

It starts 185 feet below the Pittsburgh Coal bed.

Pauline E. Snodgrass No. 2 Well Record (No. 87 on Map II).

Birch District, Braxton County, on Mill Fork, 0.3 mile southeast of Rosedale; authority Mill Fork Oil & Gas Co.; elevation, 840' B.

	Top. Feet.	Bottom. Feet.
Sand, Burning Springs, Upper Freeport (gas, 488'; water, 490')	480	535
Sand, Gas, Lower Freeport	560	567
Coal, Lower Kittanning	672	675
Sand, Second Cow Run, Homewood	745	787
Sand, Salt	935	960
Sand, Salt (gas, 1263')	1238	1390
Sand, Rosedale Gas	1400	1468
Sand, Salt (oil, 1567'-1575'; gas show, 1580')	1520	1580
Sand, Maxton (oil show in top)	1660	1710
Big Lime	1710	1780
Sand, Big Injun	1786	1867
Total depth		2000

10" casing, 115'; 8¼" casing, 570'; 6⅝" casing, 1531'; 6- to 7-bbl. well.

The above well starts 145 feet below the Pittsburgh Coal bed.

The detailed log of the J. W. **Twyman No. 1 well—No. 84 on Map II**—located on the west bank, 0.1 mile up Mill Fork of Right Fork, is published in Chapter IV in connection with the Rosedale Section, pages 76-7.

In the first oil pool of the Rosedale Field, mentioned on a preceding page at the beginning of the discussion of well records in Birch District, 10 wells had been completed in September, 1915, some of which were still producing oil and 4 were dry holes. Since this pool is barely in the edge of Gilmer County and the records of its wells contain much of interest and importance to Braxton, space is warranted for the republication of the 6 following well records, which, with slight modifications and additions, are as published on pages 495-7 of the Lewis-Gilmer Report and pages 388-390 of Volume I(a):

W. G. Bennett No. 2 Well Record (No. 89 on Map II).

Center District, on Anthony Fork, 2.1 miles southwest of Rosedale; authority, South Penn Oil Co.; elevation, 1150' B.

	Top. Feet.	Bottom. Feet.
Sand, Moundsville, Saltsburg	450	500
Sand, Upper Mahoning	600	640
Sand, Burning Springs	780	840
Lime	840	955
Sand, Gas, East Lynn	955	1000
Sand, Second Cow Run (gas, 1040'), Homewood	1030	1150
Sand, Salt	1390	1420
Sand, Salt	1475	1530
Coal, Sewell?	1810	1813
Sand, Rosedale Salt	1876	1960
Little Lime	2000	2025
Pencil Cave	2025	2040
Big Lime	2040	2125
Sand, Big Injun	2125	2220
Shells	2220	2420
Sand, Berea	2420	2435
Sand, Fifty-foot	2580	2595
Slate, lime, and shells	2595	3090
Hard lime shells to bottom	3090	3275

The above well was a gasser and is still productive. It starts 165 feet above the horizon of the Pittsburgh Coal bed and is the only well in the pool to be drilled on down to the Big Injun and through the sands of the Catskill Series. The Thirty-foot, Gordon Stray, Gordon, Fourth, Fifth, and Bayard have thinned away entirely. The only gas pay recorded is that at 1040 feet in the Second Cow Run, so that the present production of the well is probably from that zone.

W. G. Bennett No. 7 Well Record (No. 91 on Map II).

Center District; on Anthony Fork, 2.3 miles southwest of Rosedale; authority, South Penn Oil Co.; elevation, 1110′ B.

	Top. Feet.	Bottom. Feet.
Sand, Grafton	400	450
Slate and red rock	450	700
White sand, Big Dunkard, Lower Mahoning	700	760
Sand, Burning Springs	800	830
White sand, Second Cow Run	900	925
Slate and lime	925	1180
Sand, Rosedale "Gas"	1400	1430
Slate and shells	1430	1712
Salt Sand, Rosedale (oil rock) to bottom	1712	1733

The above well starts about 130 feet above the Pittsburgh Coal bed.

W. G. Bennett No. 8 Well Record (No. 92 on Map II).

Center District; on Anthony Fork, 2.4 miles southwest of Rosedale; authority, South Penn Oil Co.; elevation, 960′ B.

	Top. Feet.	Bottom. Feet.
Coal, Mercer?, Stockton?	980	984
Coal, Sewell?	1670	1674
Salt Sand, Rosedale (oil rock)	1680	1686
Total depth		1740

The above well was considered a dry hole, and it starts about 70 feet above the horizon of the Pittsburgh Coal bed.

W. G. Bennett No. 1 Well Record (No. 93 on Map II).

Center District; on Anthony Fork, 2.2 miles southwest of Rosedale; authority, South Penn Oil Co.; elevation, 960′ B.

	Top. Feet.	Bottom. Feet.
Soil and quicksand	0	34
Sand, Connellsville and Lower Connellsville	34	160
Red rock, Clarksburg	160	262
Sand, Grafton	262	300
Slate and red rock	300	400
Sand and lime	400	460
Coal, Brush Creek	465	472
Sand	505	530
Lime	530	550
Sand	550	560
Sand, Big Dunkard, Lower Mahoning	577	590

	Top. Feet.	Bottom. Feet.
Lime	661	690
Sand, Lower Freeport	700	730
Sand, Salt	900	928
Lime	1020	1155
Sand, Salt	1155	1165
Sand, Salt	1184	1225
Sand, extra hard, Salt	1290	1415
Coal, Sewell?	1547	
Salt Sand, Rosedale	1560	1580
Slate	1580	1585
Salt Sand, Rosedale (oil and gas, 1592'; oil, 1600'; salt water, 1610')	1585	1610

The above well starts 40 feet below the Pittsburgh Coal bed.

W. G. Bennett No. 6 Well Record (No. 94 on Map II).

Center District; on Anthony Fork, 2.3 miles southwest of Rosedale; authority, South Penn Oil Co.; elevation, 1145' B.

	Top. Feet.	Bottom. Feet.
Sand, Grafton	438	465
Sand, Moundsville, Saltsburg	540	558
Sand, Little Dunkard, Lower Mahoning	672	712
Sand, Burning Springs, Upper Freeport	780	830
Sand, Second Cow Run	950	1154
Sand, Salt	1350	1380
Sand and lime	1440	1727
Salt Sand, Rosedale (oil, 1747')	1730	1756

The above well starts about 140 feet above the Pittsburgh Coal bed.

W. G. Bennett No. 5 Well Record (No. 95 on Map II).

Center District; on Anthony Fork, 2.2 miles southwest of Rosedale; authority, South Penn Oil Co.; elevation, 1030' B.

	Top. Feet.	Bottom. Feet.
Sand, Murphy, Lower Connellsville and Morgantown	150	250
Sand, Grafton	300	345
Red rock, Pittsburgh	345	350
Sand, Upper and Lower Freeport, Burning Springs and Gas	645	855
Sand, Second Cow Run, Homewood	880	980
Sand, Salt	1180	1280
Slate and shells	1280	1380
Gas Sand, Rosedale (gas, 1485')	1465	1500
Lime and shells	1500	1535

	Top. Feet.	Bottom. Feet.
Black slate	1535	1625
Coal, Sewell?	1635	1645
Salt, Sand, Rosedale (oil rock)	1665	1685
Slate and shells to bottom	1685	1778

The above well starts about 25 feet above the horizon of the Pittsburgh Coal bed.

Both the oil pools in the **Rosedale Field** conform in an ideal manner with the structural theory of gravity separation, in that they lie about half-way up the western slope of the Sleith Fork Anticline from the low point of the **Rosedale Basin**, the oil zone—Rosedale Salt Sand—being water-bearing. It is reasonable to assume the possibility of these finally connecting into one and the same pool, say closely along the 950-foot contour of the Pittsburgh Coal as it is outlined on Map II. In September, 1915, there had been no dry holes completed along this line to prove the contrary.

The following is the record of a well that is located about 100 feet higher up the structural slope and starts about 75 feet below the horizon of the Pittsburgh Coal bed, as determined on the ground by the writer. Shows of gas were found in both the Rosedale Gas and Salt Sands, but it has been abandoned as non-paying in September, 1915:

Wm. Miller No. 1 Well Record (No. 99 on Map II).

Birch District; on branch of Mill Fork, 2.9 miles southwest of Rosedale, and 2 miles northwest of Sleith; authority, Hawkins and Ward; completed, 1915; elevation, 1005′ B.

	Top. Feet.	Bottom. Feet.
Sand, Rosedale Gas (gas at 1360′)	1310	1475
Sand, Rosedale Salt (gas at 1590′)	1570	1600
Sand, Salt, to bottom	1660	1678

The following is the record of a fine gasser from the Rosedale Gas and Salt Sands, that is located nearly on the crest of the Sleith Fork Anticline, and taken in conjunction with the oil pool in the same zones at Rosedale, corroborates in a striking manner the structural theory of gravity separation of water, oil, and gas. The well starts about 250 feet below the horizon of the Pittsburgh Coal bed, and the log, with the exception of some slight changes and additions in correlations, is as published on pages 494-5 of the Lewis-Gilmer Report of the State Geological Survey:

Rebecca Bourn No. 1 Well Record (No. 100 on Map II).

Birch District, Braxton County; on west bank of Right Fork of Steer Creek, 1.0 mile southeast of Rosedale; authority, Pittsburgh & W. Va., Gas Co.; completed in September, 1914; elevation, 795' B.

			Thickness. Feet.	Total. Feet.
Unrecorded			37	37
Red rock			73	110
Lime			15	125
Red rock			25	150
Slate			50	200
Sand	20'	Buffalo	55	255
Slate	10			
Water sand, Little Dunkard	25			
Slate			120	375
Sand, Burning Springs, (Upper Freeport)			95	470
Coal, Lower Freeport			3	473
Slate			27	500
Lime			14	514
Unrecorded			83	597
Coal, Lower Kittanning			3	600
Sand, Second Cow Run (Homewood)			35	635
Slate			5	640
Sand, Salt			24	664
Coal, Stockton?			2	666
Slate and shells			124	790
Sand, Salt			60	850
Slate			152	1002
Sand, Salt			15	1017
Lime			158	1175
Gas Sand, Rosedale (gas, 1203')			55	1230
Slate and lime			123	1353
Salt Sand, Rosedale (gas, 1355-60')			32	1385

"13" casing, 40'; 10", 155'; 8¼", 765' 5"; 330 lbs. pressure in 20 minutes—8¼" casing gave way or pressure would have been greater; 38/10" water in 8¼" casing; volume, 5,750,000 cu. ft. daily."

Southeastward in Birch District, 6 practically dry holes—**Nos. 101 to 106 on Map II**—have been drilled on Right Fork of Steer Creek on the Baldwin Heirs Estate. The following is the record of the one farthest down stream:

Baldwin Heirs No. 5 Well Record (No. 101 on Map II).

Birch District, Braxton County; on Steer Creek, 1.7 miles just north of east of Sleith; authority, G. L. McKain; completed, November 17, 1905; elevation, 850′ B.

	Thickness. Feet.	Total. Feet.
Clay	10	10
Gravel	13	23
Lime	17	40
Sand, Morgantown	45	85
Red rock	15	100
Lime	20	120
Red rock	8	128
Lime	10	138
Red rock	15	153
Lime	10	163
Red rock 12′	37	200
Slate, white 15		
Red rock 10		
Slate, white	100	300
Lime	10	310
Red rock	35	345
Lime	15	360
Slate, white	43	403
Sand, Little Dunkard	15	418
Slate, white	10	428
Slate, black	20	448
Slate, white	5	453
Limestone, Upper Freeport	22	475
Sand, Burning Springs, (Upper Freeport)	23	498
Limestone	12	510
Sand to bottom	4	514

8¼″ casing, 155′; 6⅝″ casing, 460′; all casing was pulled; abandoned as a dry hole.

The above well starts about 175 feet below the horizon of the Pittsburgh Coal as determined on the ground by Gawthrop.

The detailed log of **Baldwin Heirs No. 3 Well—No. 102 on Map II**—located in run, one-eighth mile northeast of the well last given, is published in Chapter III, pages 77-79, in connection with the Sleith Fork Section. A show of oil is reported in the Big Dunkard Sand and a gas show in the Rosedale Salt Sand. The boring penetrated to 1039 feet below the Big Injun and reveals the complete absence of the Berea Sand and those of the Catskill Series. From a structural standpoint, this boring was well located for oil, since in this portion of the Appalachian Basin, the sands last mentioned are non-water-bearing, a feature that would have permitted the force of gravity to segregate any contained oil in the sands into a commercial pool along the floor of the Tague Fork Syncline had these zones been present in a porous condition.

The following log of a dry hole, starting 140 feet below the Pittsburgh Coal and completed June 1st, 1917, was kindly furnished the Survey by C. E. Krebs of Charleston, as also its approximate location on Map II. The oil showing at 415 feet is evidently in the Big Dunkard Sand or Upper Mahoning ledge of the Conemaugh. The record reveals the absence of sand reservoirs for an interval of 945 feet below the Big Injun:

Morrison No. 1 Well Record—No. 102A on Map II.

Birch District, 4.5 miles southeast of Rosedale, at mouth of Dry Fork of Right Fork of Steer Creek; by Preston Oil Co.; elevation, 880′ L.

	Thickness. Feet.	Total. Feet.
Soil	16	16
Slate	44	60
Slate, red rock	340	400
Sand, Upper Mahoning (show of oil, 415′)	20	420
Slate	50	470
Sand, hard, Lower Mahoning	15	485
Lime, gritty	145	630
Coal, Upper Kittanning	4	634
Lime, sandy	141	775
Black slate	10	785
Sand, hard	15	800
Shale, limy	50	850
Slate and shells	30	880
Sand	80	960
Lime	40	1000
Sand	30	1030
Black slate	30	1060
Sand lime	90	1150
Slate and shells	50	1200
Sand	50	1250
Black lime	50	1300
Slate	50	1350
Hard lime	90	1440
Sand	70	1510
Lime and shells	150	1660
Sand, Maxton (gas, 30,000′)	50	1710
Red rock	72	1782
Slate	80	1862
Little Lime	35	1897
Pencil Cave	12	1909
Big Lime	100	2009
Big Injun Sand	101	2110
Slate	75	2185
Lime shells	120	2305

	Thickness. Feet.	Total. Feet.
Red rock	60	2365
Lime and shells	200	2565
Shale and shells	490	3055

"Dry hole; well abandoned."

The **Baldwin Heirs No. 2 Well—No. 103 on Map II**—located 0.4 mile up Dry Fork and 3.6 miles northwest of Frametown and examined on the ground by Gawthrop, starts about 135 feet below the horizon of the Pittsburgh Coal bed and penetrated to a depth of about 1700 feet, according to J. S. Carr of Belfont, Braxton County. Its log could not be obtained, but it evidently did not reach down to the Big Lime. It was abandoned as a dry hole.

The **Baldwin Heirs No. 4 Well—No. 104 on Map II**—located on Dry Fork, 1.5 miles southwest of Belfont, and 4.2 miles southeast of Rosedale on the steep western slope of the Gassaway Anticline, and examined by Gawthrop, starts about 100 feet below the horizon of the Pittsburgh Coal bed, and penetrated to a depth of about 2500 feet, according to Mr. Carr above mentioned. The Survey was unable to obtain its log, but it evidently penetrated through the horizon of the Berea Sand without finding either oil or gas in paying quantities.

The **Baldwin Heirs No. 1 Well—No. 105 on Map II**—located at the mouth of Frame Fork of Dry Fork, 2.7 miles northward from Frametown on the steep western slope of the Gassaway Anticline, penetrated to a depth of about 2800 feet, according to J. S. Carr, and found only a show of gas in a sand the depth of which was not learned. The Survey was unable to obtain its log, but, according to Gawthrop, it starts about 190 feet below the horizon of the Pittsburgh Coal bed and reached a depth of about 900 feet below the top of the Big Injun Sand or through the horizon of the Bayard, the Big Injun in this region belonging about 2100 feet below the coal last mentioned. Gawthrop reports that sufficient gas was found for fuel to run the drilling machinery and that a strong stream of fine fresh water was flowing from the well mouth on September 11, 1915.

The **Baldwin Heirs No. 6 Well—No. 106 on Map II**—located on Dry Fork, one-eighth mile southwest of the well last described and examined by Gawthrop, starts about 180 feet below the horizon of the Pittsburgh Coal bed, penetrated to a depth of about 3300 feet, according to Mr. Carr above mentioned; and was finally abandoned as a dry hole. Since it reached a depth of almost 1400 feet below the top of the Big Injun, the Chemung Series was evidently penetrated.

The following is the record of a well, examined by the writer, that starts about 330 feet above the Upper Kittanning Coal and 460 feet below the Pittsburgh bed, in which only very light shows of gas were found at depths of 1438′ and 1453′ in a sand that probably correlates with the **Rosedale Salt** instead of the **Squaw** as given in the original log, since if due allowance is made for the known rapid expansion of the Pottsville Series southeastward from **Well No. 102 on Map II,** the top of the Big Injun should come at a depth of about 1800 feet. The correlations in parentheses are those in the original record:

R. A. Young No. 2521 Well Record (No. 106A on Map II).

Birch District; on Tate Creek, ⅛ mile southeast of Tate; drilled by Hope Natural Gas Co.; authority, Earl Fox, of Sutton, W. Va.; completed, December 7, 1912; elevation, 966′ L.

	Top. Feet.	Bottom. Feet.
Sand, (Little Dunkard?) Burning Springs	185	215
Coal, Chilton?	720	730
Sand, First Salt	775	800
Sand, Second Salt	800	845
Sand, (Maxton?)	1030	1075
Sand (Big Injun?) "Rosedale Gas"	1265	1325
Sand	1345	1435
Sand, (Squaw?) (gas, 1438′ and 1453′, would make no test through ½″) **Rosedale Salt**	1438	1609
Sand, (Berea?)	1616	1646
Sand, (Fifty-foot?)	1650	1700
Sand, (Thirty-foot?)	1705	1720
Lime, **Big Lime**	1738	1800
Sand, (Gordon Stray?), **Big Injun**	1807	1970
Red rock	1970	2023
Sandy shells	2148	2152
Total depth		2505

"Shot at 1437-1443′ with no results. Plugged and abandoned."

The following record of a deep well, located 4.3 miles northwestward in Birch District, corroborates the correlations of the writer in the record last given, the intervals being slightly less, as expected. The boring, examined by the writer, starts about 160 feet below the horizon of the Pittsburgh Coal bed and penetrates into the top of the Chemung Series:

P. M. Morris No. 1074 Well Record (No. 108 on Map II).

Birch District, Braxton County; on Left Fork, 0.6 mile east of Elmira; authority, Hope Natural Gas Co.; completed, November 14, 1908; elevation, 1025′ B.

	Thickness. Feet.	Total. Feet.
Unrecorded	20	20
Red rock	115	135
Sand	30	165
Red. rock	115	280
Slate	135	415
Sand, Lower Mahoning, and Upper Freeport	170	585
Lime	25	610
Sand	50	660
Lime shells	10	670
Sand	30	700
Coal, Lower Kittanning	3	703
Lime	9	712
Sand, Homewood	78	790
Slate	70	860
Sand	40	900
Slate	60	960
Sand	70	1030
Slate	115	1145
Sand	135	1280
Slate	50	1330
Lime	10	1340
Slate	110	1450
Sand, Rosedale Gas	50	1500
Slate	30	1530
Sand, hard, Rosedale Salt	110	1640
Slate	10	1650
Lime	5	1655
Sand	18	1673
Lime shells	21	1694
Sand	66	1760
Red rock	52	1812
Lime	58	1870
Slate	20	1890
Lime	10	1900
Pencil Cave	15	1915
Big Lime	75	1990
Sand, Big Injun	285	2275
Red rock	20	2295
Slate	135	2430

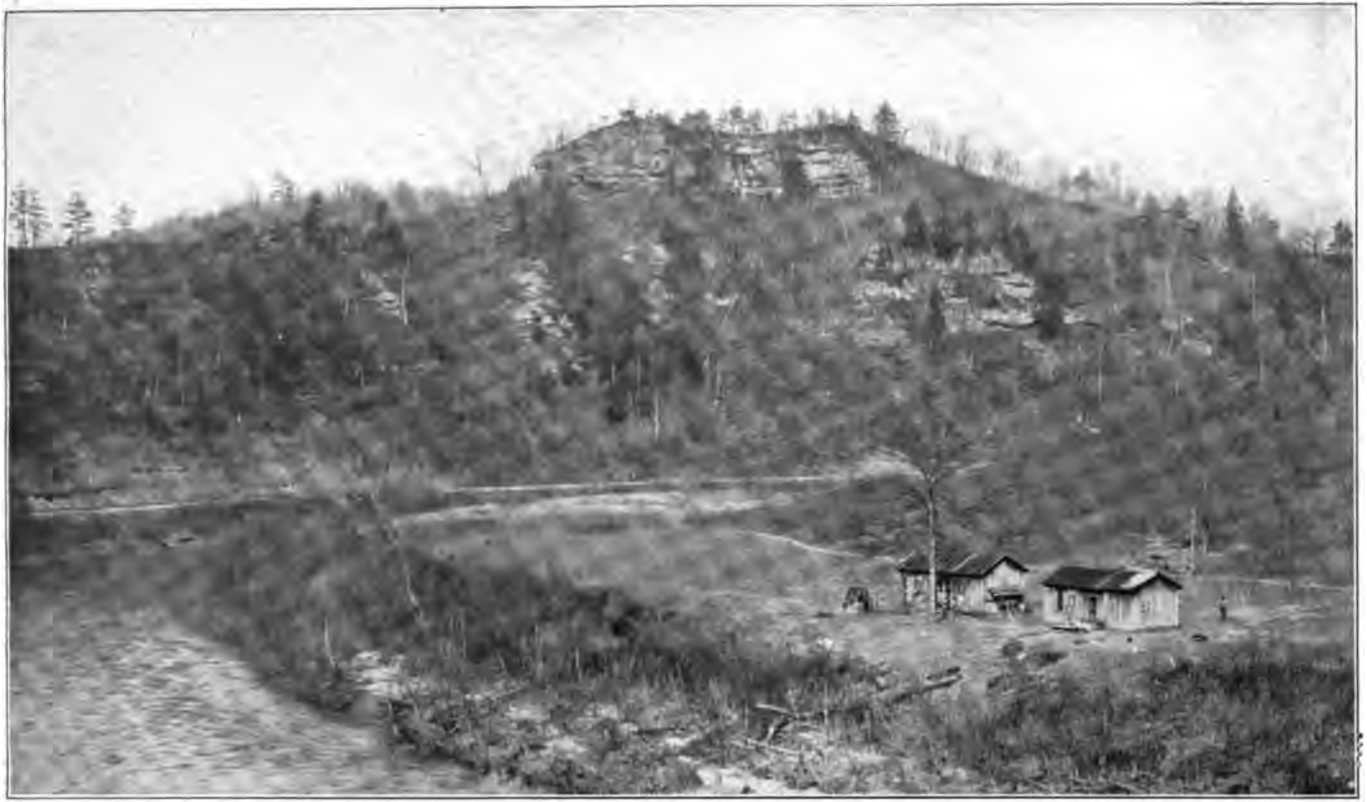

PLATE XIII.—Showing "End of the World" cliff exposures on Elk River; Upper Freeport (at top), Upper East Lynn and East Lynn Sandstones (See Groves—1 Mile Southwest Section, page 111).

	Thickness. Feet.	Total. Feet.
Red rock	50	2480
Slate	30	2510
Lime shells	60	2570
Red rock	20	2590
Slate shells	40	2630
Slate	470	3100
Slate and lime shells (small and slight show of oil at 3110')	104	3204

13" casing, 18'; 10" casing, 440'; 6⅝" casing, 1915'; 10" hole rereduced at 925'.

The above well was abandoned as a dry hole, only a showing of oil being found near the horizon of the **Elizabeth Sand.** The record shows the absence of the Berea and the sands of the Catskill Series.

The following is the record of a test well completed during October, 1916, that starts about 40 feet below the outcrop of what appears to be the Brush Creek Coal:

S. F. Griffin No. 1 Well Record (No. 107 on Map II).

Birch District, Braxton County; on Tate Creek, 1¼ miles northwest of Glendon; by Crooked Fork Oil Co.; authority, Earl Fox, elevation, 915' B.

	Thickness. Feet.	Total. Feet.	
Sand and gravel	40	40	
Sand	95	135	
Coal, Lower Freeport?	4	139	139'
Sand	16	155	
Sand	120	275	
Sand	45	320	
Coal, No. 5 Block	6	326	187'
Shale and slate	59	485	
Sand	105	590	
Slate and shels	114	704	
Lime	56	760	
Unrecorded	40	800	
Slate and unrecorded	250	1050	
Sand	60	1110	
Slate and lime	20	1130	
Sand	70	1200	
Sand and shells	120	1320	
Sand, Salt (oil at 1371'—8' of pay; water in oil, 1 bailer of water each hour. Two pays about 6' apart. Most of water in second pay. Oil started off making about ⅛ bailer each hour)	77	1397	
Red rock	45	1442	
Sand	60	1502	

	Thickness. Feet.	Total. Feet.
Slate and shells	80	1582
Little Lime	30	1612
Break of slate, etc.	18	1630
Sand, white and clean, (gas at 1634', about 100,000' daily)	15	1645
Slate	20	1665
Big Lime	108	1773
Big Injun Sand (no good)	120	1893
Red rock, brown	45	1938
Slate and shells to bottom	432	2370

Casing record: 10" casing, 115'; 8" casing, 704'; 6⅝" casing, 1726½'.

"The gas in this well is being saved by the farmer and we can later get a definite report on it."

PROSPECTIVE OIL AND GAS AREAS, BIRCH DISTRICT (BRAXTON).

A careful study of the foregoing well records in Birch District, Braxton County, and the structural conditions associated with the wells, leads to the conclusion that over a great portion of its area the chances are poor to find a prolific oil or gas pool, this being especially true for the sands below the Big Injun, as these appear to be lacking almost entirely, a feature that is also prominent in eastern Clay County. So that the same lack of sands below that last mentioned should be expected in that part of Birch lying southeast of Elk River, where no well has yet been drilled. However, there are some areas that are specially favored by structure or development or both, that warrant mention. (1) That region lying immediately along the 950-foot contour of the Pittsburgh Coal bed for a width of one-half mile between the two Salt Sand oil pools of the Rosedale Field, appears favorable for oil in the same sand; (2) that, along the crest of the Sleith Fork Anticline southwestward from the Otter-Birch District Line to the head of Slab Fork of Cowskin, 1 mile south of Rattlesnake Knob, for gas in the same sand, in view of the fine gasser obtained in well No. 100 on Map II—described on a preceding page of this Chapter—with a chance for gas in the Rosedale Gas and Big Injun Sands; (3) that, on the structural terrace outlined by the wide divergence of the 1200- and 1250-foot structure contours of the Pittsburgh Coal on the headwater drainage of Duck Creek, for oil in the Big Injun and higher Sands, but the absence of gas in paying quantities in wells Nos. 106A and 113 on Map II, 2½ to 3 miles southeastward, higher up the structural slope, makes it very problematical whether or not petroleum exists in the zones in question in this region; and (4), that, on the wide and almost flat structural terrace formed by the wide divergence of the 675- and 725-foot contours of the Upper Kittanning Coal northeastward from Tate Creek to the Birch-Otter District Line, for oil in the Big Injun and higher sands, since it is on such structural forms that some of the best oil pools of the State occur. If a sufficient number of elevations on the top of the Big Injun could be obtained to make a structure contour map on it, it is very probable that a marked synclinal basin would be shown extending in a northeast-southwest direction along the terrace in question that would connect up the Handley and Gassaway Synclines. The rapid southeast expansion of the Pottsville Series no doubt causes the apparent terrace, with the contours based on the Upper Kittanning Coal. The completion of the **S. F. Griffin No. 1 Well—No. 107 on Map II**—located on Tate Creek, 1¼ miles northwest of Glendon, and another, say on the north bank of Elk, about 1 mile east of Frametown, through the Big Injun, should fairly test this terrace. (5) The high structural level occupied by the southeast border of Birch makes this portion of the District appear favorable for gas in the Big Injun and higher Sands. A test well on Birch River near Herold, or another on Strange Creek near the intersection of the latter with the 1200-foot contour of the Upper Kittanning Coal, would in a measure test this region, ever keeping in mind the remarks given on a preceding page of this Chapter under the discussion of Prospective Areas in Salt Lick District.

DETAILED WELL RECORDS IN HOLLY DISTRICT (BRAXTON).

Holly District occupies the southeast portion of Braxton County, the strata over the whole of its surface having a rapid northwest dip, as may be readily seen on Map II, the horizon of the Upper Kittanning Coal rising from about 625 feet above sea-level, 1.5 miles southwest of Flatwoods, to 1975 feet above the same datum at the common corner of Braxton, Webster, and Nicholas Counties. Only 6 wells have been drilled within its area, all of which were abandoned as dry holes.

The following is the record of one of these, located in the northwest edge of the District, which starts slightly less than 400 feet below the horizon of the Pittsburgh Coal, as near as could be determined by the writer. Through the courtesy of Mr. Earl Fox, of Sutton, interested in the well, special pains were taken to keep an accurate log for the Survey of all the strata penetrated. Only slight shows of oil or gas were found and these occurred in the Big Lime, Big Injun, Fourth, and Fifth Sands:

Wm. Fisher No. 1 Well Record (No. 109A on Map II).

Holly District, Braxton County; on branch of Granny Creek, 0.4 mile due north of McNutt; by Crooked Fork Oil Co.; authority, Earl Fox; completed in Fall of 1915; elevation, 1090′ B.

	Thickness. Feet.	Total. Feet.
Conductor	12	12
Sand, Saltsburg	18	30
Slate	20	50
Red rock	10	60
Sand, Buffalo, (hole full of water at 70-85′)	25	85
Slate	10	95
Sand, Upper and Lower Mahoning	105	200
Slate	35	235
Coal, Upper Freeport	4	239
Slate	11	250
Sand, Upper Freeport (1 bailer of water per hour at 265′)	50	300
Slate and lime shells (puff of gas at 350′)	110	410
Sand	230	640
Slate and lime shells	275	915
Sand	45	960
Slate and shells	45	1005
Sand	60	1065
Slate and shells	83	1148
Sand, Rosedale Gas	23	1171
Slate and shells	150	1321
Sand, Rosedale Salt	160	1481
Slate	19	1500
Red rock	28	1528
Slate and shells	50	1578
Little Lime	12	1590
Pencil Cave	21	1611
Sand, broken (very small show of oil at 1625′)	32	1643
Big Lime (puff of gas at 1710′)	67	1710

	Thickness. Feet.	Total. Feet.
Sand, limy, Big Injun (very small show of oil at 1805')	165	1875
Slate	65	1940
Lime and shells	100	2040
Slate	155	2195
Sand, Gordon Stray?	5	2200
Slate	150	2350
Sand, Fourth? (very small show of oil at 2350')	3	2353
Slate	47	2400
Sand, Fifth? (very small show of oil at 2400')	4	2404
Slate and shells to bottom	379	2783

12 (?) bailers of salt water per hour at 1625'; 10" casing, 138⅜'; 8" casing, 711'.

The **John Adams No. 1 Well—No. 109B on Map II**—located on the west bank of Lower Flatwoods Run, 3½ miles northeast of Sutton, and examined by the writer, starts about 400 feet above the Upper Kittanning Coal, 350 feet below the horizon of the Pittsburgh bed, and penetrated to a depth of about 2500 feet, according to Mr. J. O. Baxter who hauled the casing to the well, or to approximately 700 feet below the top of the Big Injun Sand, or through the Gordon. The Survey was unable to obtain its log, but it was drilled about 13 years ago by a C. E. Bonwell and abandoned as a dry hole.

The following is the record of a deep well in the northern edge of Holly District which starts about 570 feet below the horizon of the Pittsburgh Coal, as determined by the writer, not a show of either oil or gas being reported, although what appears to be the Gordon Sand is present in good thickness and quality:

J. B. Marple No. 2349 Well Record (No. 109C on Map II).

Holly District, Braxton County; on branch of Tom Hughes Fork, 1.5 miles southeast of Corley; authority, Hope Natural Gas Co.; completed, January 24, 1913; elevation, 1125' B.

	Thickness. Feet.	Total. Feet.
Sand and gravel	30	30
Slate	40	70
Sand, Lower Freeport	100	170
Coal, Upper Kittanning	5	175
Sand, Upper East Lynn and East Lynn	125	300
Slate, coal showing at 355', No. 5 Block?	145	445
Coal, Stockton	6	451
Slate	49	500

	Thickness. Feet.	Total Feet.
Sand, Salt	300	800
Slate	50	850
Sand, Rosedale Gas	150	1000
Slate	50	1050
Sand, Rosedale Salt	150	1200
Slate	50	1250
Sand	50	1300
Red rock	190	1490
Big Lime	79	1569
Sand, Big Injun	130	1699
Unrecorded	170	1869
Shells, Gantz?, Berea	11	1880
Unrecorded	110	1990
Sand, Fifty-foot	53	2043
Unrecorded	97	2140
Shells, Gordon Stray	3	2143
Unrecorded (no Gordon Sand)	59	2202
Sand, Fourth?, good, pebbly, Gordon	57	2259
Unrecorded	106	2365
Sand, Fifth	25	2390
Unrecorded to bottom	434	2824

8" casing, 840'; 6" casing, 2223'.

The following is the record of another deep well that starts about 340 feet below the Upper Kittanning Coal, as determined by the writer. Only a "smell" of oil and gas is reported and it occurred in the Fifth Sand, the latter being only 4 feet in thickness and the Gordon, 25 feet:

A. M. Berry Heirs No. 2475 Well Record (No. 109D on Map II).

Holly District, Braxton County; on east bank of Kanawha Run, 0.8 mile north of Holly; authority, Hope Natural Gas Co.; completed, May 14, 1912; elevation, 1025' B.

	Top. Feet.	Bottom. Feet.
Sand, Rosedale Gas	390	437
Coal, Sewell?	562	568
Sand, Rosedale Salt	622	662
Sand, Rosedale Salt	755	780
Unrecorded (water at 788')	780	823
Sand, Second Salt	823	915
Sand	1040	1125
Little Lime	1180	1195
Big Lime	1195	1240
Sand, Big Injun	1240	1346
No Squaw Sand		
Sand, Gantz?, Berea	1638	1668
No Fifty-foot, Thirty-foot, or Gordon Stray Sands		

	Top. Feet.	Bottom. Feet.
Sand, Gordon	1817	1842
No Fourth Sand		
Sand, Fifth (smell of oil and gas at 2008')	2008	2012
Unrecorded	2012	2383

10" casing, 215'; 8¼" casing, 762½'; 6⅝" casing, 1255'.

The **Hanson C. Coger No. 1 Well—No. 109E on Map II**—located just on the east side of the Baltimore and Ohio Railroad, 0.5 mile north of Baker Run Station and examined by the writer, starts about 440 feet below the horizon of the Upper Kittanning Coal, and penetrated to a depth of about 2900 feet, according to Luke Skidmore, who lives near the well. Hence, it penetrated about 1750 feet below the top of the Big Injun or deep into the Chemung Series, and was finally abandoned as a dry hole. The Survey was unable to obtain its log.

The detailed log of the **Centralia Well—No. 109F on Map II**—located on the east bank of Laurel Creek at Centralia, near the east end of the Baltimore and Ohio Railroad bridge over this stream, is published in Chapter IV, pages 101-3, in connection with the Centralia Section. A show of oil is recorded in the Big Injun at a depth of 1095 feet. Three sands of the Catskill Series; viz, Gordon, Fifth, and Bayard, are reported in fair thickness and quality.

PROSPECTIVE OIL AND GAS AREAS, HOLLY DISTRICT (BRAXTON)).

All the test wells for oil and gas thus far completed in Holly District have been negative in their results as revealed above, and the lack of prominent interruptions to the prevailing rapid northwest dip of the strata throughout its area, makes it a very difficult matter for the geologist of select possible productive areas. Since the southeast border of the District occupies a comparatively high structural level and Elk River has cut a very deep gorge in the surface rocks between Palmer and the Braxton-Webster County Line, the valley floor at Centralia offers a feasible point to test the very deep sands; viz, the **Ragland Sand** of Kentucky oil fields at the very base of the Devonian, and the **Clinton Sand** of Ohio oil fields in the Silurian. Just at what depths these could be found in the **Centralia No. 1 Well—No. 109F on Map II**—is very problematical, but it is believed that the first might be found at about 4000 feet below the top of the Big Injun, and the second at about 5000 feet below the same datum, or at depths of about 5000 and 6000 feet, respectively. This region is mentioned for deep sand tests mainly because it probably offers the least depths in the territory of this Report at which these zones can be reached with the drill.

The northeast corner of Holly District or that portion included in the drainage basins of Laurelpatch and Mudlick Runs may hold some Gordon Sand gas in paying quantities, due to the thick sand encountered at this horizon in wells Nos. 109C and 109D, described above, and the comparatively high structural level of the locality in question. In the southern portion of the same District, the Big Injun and the sands of the Catskill may be reached in a test well of comparatively shallow depth along the valley floor of Little Birch River between Little Birch P. O. and the Braxton-Webster Line, but, for reasons already mentioned above, one location is as good as another in this "wildcat" region as the latter term is applied in the parlance of the oil well driller.

WELL RECORDS AND PROSPECTIVE AREAS, CLAY COUNTY.

EARLY HISTORY.

The earliest attempts to drill for oil and gas in Clay County were the **Tallman, Gross, and Shelton wells—Nos. 120, 121, and 122 on Map II**—located in the northwest portion of Henry District and completed about 15 years ago, all three of which were practically dry holes, although shows of oil are recorded in the log of the latter well as exhibited on a subsequent page of this Chapter. According to information given by Mr. H. B. Davenport, of Clay, the first producing gas well to be completed was the **L. D. Graham No. 1—No. 213 on Map II**—located in the western edge of Union District, on the head of Harts Branch, 1 mile east of Queen Shoals; finished on

September 17, 1907; and having an initial production of 1,800,000 cubic feet of gas daily from the Keener Sand. This well is still producing gas. According to the same authority, the **first oil producer** to be completed in the County was the **Connell Heirs No. 1 Well—No. 189 on Map II**—also located in Union District, 1.3 miles west of Birch, and completed on April 29, 1911, by the Raven Carbon Black Company. It opened the Big Injun Sand oil field in this region and had an initial production of 24 barrels of oil daily, settling to 5, and still making on November 15, 1915, 2 to 3 barrels daily.

SUMMARIZED RECORDS.

The following table, similar to that published for Braxton on pages 286 to 289, is a compilation from all the detailed records available in Clay County, as also others in the immediately adjoining portions of Roane, Kanawha, and Nicholas Counties. The same explanations that accompany the Braxton County table are applicable here. The following abbreviations of names are used in the column headed "Owner":

Big Otter O&G	Big Otter Oil & Gas Company.
Birch Run	Birch Run Oil Company.
Blue Knob	Blue Knob Oil & Gas Company.
Carter	Carter Oil Company.
Chalmers O&G	Chalmers Oil & Gas Company.
Charleston	Charleston Oil Well Supply Company.
Crude Oil	Crude Oil Company.
Davenport O&G	Davenport Oil & Gas Company.
Eastern Carbon	Eastern Carbon Black Company.
Eldorado O&G	Eldorado Oil & Gas Company.
Elk River O&G	Elk River Oil & Gas Company.
Goshorn O&G	Goshorn Oil & Gas Company.
Hartland O&G	Hartland Oil & Gas Company.
Hope	Hope Natural Gas Company.
Ivydale O&G	Ivydale Oil & Gas Company.
King Ridge	King Ridge Oil Company.
Koontz O&G	Koontz Oil & Gas Company.
Lackawanna	Lackawanna Coal & Lumber Company.
Little Sycamore	Little Sycamore Oil & Gas Company.
Mt. Pisgah O&G	Mt. Pisgah Oil & Gas Company.
Ohio Fuel	Ohio Fuel Oil Company.
Public O&G	Public Oil & Gas Company.
Raven Carbon	Raven Carbon Black Company.
Samples Oil	Samples Oil Company.
South Penn	South Penn Oil Company.
United Fuel	United Fuel Gas Company.

Summarized Record of Oil and

No. on Map II	FARM NAME LOCAL WELL AND NUMBER	Magisterial District	OWNER	Elevation Above Tide
110	R. S. Hamrick No.1	Otter	Big Otter O. & G.	865B
111	J. M. Boggs No. 1	Otter	Big Otter O. & G.	852L
112	J. G. Lyons No. 1	Otter	Ivydale O. & G.	865B
113	Mollohan & Dickenson No. 1	Otter	F. P. Grosscup	815L
114	Elk River Coal & Lumber Co. No. 1576.	Buffalo	Hope	1251L
115	Elk River Coal & Lumber Co. No. 1341.	Buffalo	Hope	1150B
116	Elk River Coal & Lumber Co. No. 1553.	(Nicholas Co.)	Hope	1380B
117	McQueen No. 1	(Nicholas Co.)		1870B
118	Brooks Boggs No. 1	(Roane Co.)	Carter	800L
119	Davidson Drake	(Roane Co.)	Hope	730B
120	W. C. Tallman No. 1	Henry (Clay)	Elk River O. & G.	765B
121	J. M. Gross No. 1	Henry (Clay)	Elk River O. & G.	840L
122	Richard Shelton No. 1	Henry (Clay)	Elk River O. & G.	915B
123	Geo. W. Butcher No. 1	Henry (Clay)	Blue Knob	1020B
124	Jacob Tome Institute No. 1	Henry (Clay)	Mt. Pisgah O. & G.	704L
124A	Davenport & Elliott No. 1	Henry (Clay)	Hartland O. & G.	850B
124B	Davenport & Elliott No. 2	Henry (Clay)	Price-Hall	
125	Elk River Coal & Lumber Co. No. 1865.	Henry (Clay)	Hope	1015B
126	Elk River Coal & Lumber Co.	Henry (Clay)	Hope	1100B
127	Elk River Coal & Lumber Co. No. 1340.	(Nicholas Co.)	Hope	1385B
127A	Elk River Coal & Lumber Co.	(Nicholas Co.)	Hope	
128	Thompson Land & Coal Co. No. 2	Pleasant (Clay)	South Penn	765B
129	Thompson Land & Coal Co. No. 1	Pleasant (Clay)	South Penn	725B
130	Thompson Land & Coal Co. No. 3	Pleasant (Clay)	South Penn	775B
131	Elk River Lumber Co. No. 2	Pleasant (Clay)	Crude Oil	1110B
132	Elk River Lumber Co. No. 1	Pleasant (Clay)	Crude Oil	1180B
133	Elk River Lumber Co. No. 2	Pleasant (Clay)	Eldorado O. & G.	905
134	Lackawanna Coal & Lumber Co. No. 2	Pleasant (Clay)	Lackawanna	1365B
135	Lackawanna Coal & Lumber Co. No. 1	(Nicholas Co.)	Lackawanna	1070B
136	Lackawanna Coal & Lumber Co. No. 3	(Nicholas Co.)	Lackawanna	1260B
137	Hill-Long No. 1	(Nicholas Co.)	Coalbell Coal Co	840B
138	H. O. Havener No. 1	(Nicholas Co.)	Charleston	785B
139	B. M. Samples No. 1	Union (Clay)	Samples Oil	658L
140	Harvey Samples No. 2	Union (Clay)	Samples Oil	665B
141	Harvey Samples Salt Well	Union (Clay)		675B
142	Harvey Samples No. 1	Union (Clay)	South Penn	655B
143	Harvey Samples No. 1	Union (Clay)	Samples Oil	665B
144	Goshorn & Brown No. 532	Union (Clay)	United Fuel	665B
145	F. & M. Craig No. 1	Union (Clay)	E. Carbon	865B
146	L. H. Samples No. 1	Union (Clay)	E. Carbon	908L
147	L. H. Samples No. 2	Union (Clay)	E. Carbon	1180B
148	Brown & Goshorn No. 2	Union (Clay)	Goshorn O. & G.	910B
149	Brown & Goshorn No. 1	Union (Clay)	Davenport O. & G.	910B
150	Frank Cox No. 14	Union (Clay)	Davenport O. & G.	1030B
151	Frank Cox No. 11	Union (Clay)	Davenport O. & G.	970B
151A	Frank Cox No. 13	Union (Clay)	Davenport O. & G.	1125B
152	Frank Cox No. 2	Union (Clay)	Davenport O. & G.	1115B
153	Betty G. Bell No. 1	Union (Clay)	Davenport O. & G.	1110B
154	Betty G. Bell No. 2	Union (Clay)	Davenport O. & G.	1110B
155	Frank Cox No. 1	Union (Clay)	Davenport O. & G.	1155B
156	Frank Cox No. 6	Union (Clay)	Davenport O. & G.	1124
157	E. W. King No. 9	Union (Clay)	Ohio Fuel	1034L
158	M. J. & E. W. King No. 2	Union (Clay)	Ohio Fuel	1224L
159	M. J. & E. W. King No. 7	Union (Clay)	Ohio Fuel	1203L
160	M. J. & E. W. King No. 4	Union (Clay)	Ohio Fuel	1221L
161	Frank Cox No. 7	Union (Clay)	Davenport	1025B
162	Frank Cox No. 5	Union (Clay)	Davenport	1035B
163	C. P. Samples No. 3	Union (Clay)	Chalmers O. & G.	930B
164	C. P. Samples No. 1	Union (Clay)	Chalmers O. & G.	950B
165	C. P. Samples No. 4	Union (Clay)	Chalmers O. & G.	1025B
166	C. P. Samples No. 7	Union (Clay)	Chalmers O. & G.	1025B
167	C. P. Samples No. 5	Union (Clay)	Chalmers O. & G.	1130B
168	M. J. & E. W. King No. 1	Union (Clay)	Ohio Fuel	1198L
169	M. J. & E. W. King No 6	Union (Clay)	Ohio Fuel	1202L
170	M. J. & E. W. King No. 5	Union (Clay)	Ohio Fuel	1131L
171	W. B. Samples No. 1	Union (Clay)	Chalmers O. & G.	1140
172	Sidney Samples No. 1	Union (Clay)	Clay County O. & G.	970B
173	H. M. Minner No. 2	Union (Clay)	Ohio Fuel	965L
174	H. M. Minner No. 3	Union (Clay)	Ohio Fuel	1092L
175	H. M. Minner No. 1	Union (Clay)	Ohio Fuel	1035L
176	Melzie Moore No. 1	Union (Clay)	King Ridge	1140B
177	P. N. King No. 4	Union (Clay)	Chalmers O. & G.	1070B
178	E. W. King No. 3	Union (Clay)	Ohio Fuel	1000L

Gas Wells in Clay County.

Upper Kittanning Coal (Base)		BIG INJUN SAND (Top)		Berea Sand (Top)	Gordon Sand (Top)	5th Sand (Top)	Total Depth Feet	PRODUCING SAND AND REMARKS	No. on Map II
Depth	Elev. A. T.	Depth	Elev. B. T.						
......	......	1786	921	......	......	......	1879	Dry	110
......	......	1760	908	......	......	......	2456	B. I. gas; oil show in B. I. & Max.	111
......	......	1740	870	......	......	......	1800	Salt oil......	112
......	......	......	......	......	......	......	(2600)	Dry	113
......	......	1694	443	......	......	......	3354	B. Lm. gas show......	114
......	......	1941	791	......	......	......	3710	B. Lm. gas and oil shows......	115
......	......	1700	320	......	......	......	1809	Gas show, burning at well......	116
......	......	1750	—120	......	......	......	2500	Gas and oil shows......	117
......	......	1841	1041	......	......	......	2807	Dry, B. Lm. gas show......	118
......	......	1460	730	......	......	......	1525	B. Lm. and B. I. gas......	119
......	......	1670	905	......	......	......	3001	Dry	120
......	......	1640	800	......	2340	......	2422	B. I. gas show......	121
......	......	1634	719	......	......	......	1680	"Gas," Salt & B. I. oil shows...	122
......	......	1805	785	......	......	......	1852	Dry	123
......	......	1700	996	......	2420	......	2495	B. Lm. & B. I. oil shows......	124
......	......	1840	990	2194	......	......	2600	B. Lm. gas......	124A
......	......	2116	......	2530	......	......	2552	Dry (?)......	124B
......	......	1868	853	2230	......	......	3297	Berea gas show......	125
......	......	......	......	......	......	......	......	Location — abandoned......	126
......	......	2043	658	......	......	......	3315	Dry	127
......	......	......	......	......	......	......	1865	Dry (?)......	127A
......	......	1535	770	1985	......	......	2415	Max. & B. I. oil shows......	128
......	......	1630	905	......	......	......	2442	Salt and B. I. oil shows......	129
......	......	1697	922	......	......	......	1990	Dry, Salt and B. I. oil show......	130
......	......	1975	865	......	......	......	2103	Dry, B. I. oil and gas shows...	131
......	......	2043	863	......	......	......	2311	Dry	132
......	......	1824	919	2362	......	......	2419	Dry — —Berea oil smell......	133
......	1375	......	......	......	......	......	150	Only 150′ deep; abandoned......	134
......	......	2107	937	......	......	......	3979½	Gasser in B. Lm. 50,000 cu. ft...	135
......	......	......	......	......	......	......	......	Rig only completed......	136
......	......	1742	902	2176	......	......	2275	Dry, B. Lm. gas show......	137
......	......	1756	971	2219	......	......	2235	Knr, ¼ million gas, B. I. ¼ million	138
......	......	1389	731	......	......	......	1525	½ million gas in B. I......	139
......	......	1428	763	......	......	......	1534	4 to 5 bbls. oil in B. I......	140
......	......	......	......	......	......	......	650?	Drilled for salt water 1905-7?....	141
......	......	1415	760	......	......	......	2614	2 bbls. oil in B. I......	142
......	......	1440	775	......	......	......	1529	B. I. oil, 2 bbls. now 1½......	143
......	......	1474	809	......	......	......	2690	Max. oil & B. Lm. gas shows....	144
......	......	......	......	......	......	......	......	Dry	145
......	......	1725	817	......	......	......	1781	Knr. & B. I. gas......	146
......	......	1922	742	......	......	......	2005	B. I. gas, 3,000 000′......	147
......	......	1705	795	......	......	......	1785	Knr. gas, B. I. oil......	148
......	......	1710	800	......	......	......	1788	Knr. gas, B. I. oil, 2 bbls......	149
......	......	1839	809	......	......	......	1918	B. I. oil, 25 bbls., now 20 bbls....	150
......	......	1780	810	......	......	......	1857	B. I. oil, "Gas" & Knr. gas......	151
......	......	1920	795	......	......	......	1998	B. I. oil, 50 bbls., now 33 bbls...	151A
205	910	1920	805	......	......	......	2011	B. I. oil, 3 to 4 bbls, now 2 bbls..	152
184	926	1932	822	......	......	......	2012	B. I. oil, 4-5 bbls. now 1½ bbls..	153
......	......	......	......	......	......	......	......	B. I. oil. 4-5 bbls, now 2 bbls....	154
234	921	1970	815	......	......	......	2057	"Gas" oil & Salt gas shows, B. I. oil	155
......	......	1939	815	......	......	......	2031	B. I. oil, 32 bbls., now 10 2 yrs..	156
......	......	1846	812	......	......	......	1933	Knr. gas, B. I. oil, 1½ bbls......	157
305	919	2034	810	......	......	......	2118	B. I. oil, 2 to 3 bbls......	158
......	......	2024	821	......	......	......	2100	B. I. oil, 6 bbls., now 5, 15 mos.	159
......	......	2060	839	......	......	......	2120	B. I. oil......	160
......	......	......	......	......	......	......	......	B. I. oil, 3 bbls., now 2......	161
......	......	......	......	......	......	......	......	B. I. oil, 15-20 bbls......	162
......	......	1735	805	......	......	......	1821	B. I. oil, 3 bbls......	163
......	......	1765	815	......	......	......	1853	B. I. oil. 40 bbls, now 11......	164
125	900	1842	817	......	......	......	1925	B. I. oil, ½ bbl.. abandoned....	165
......	......	......	......	......	......	......	......	B. I. oil, 100 bbls......	166
216	914	1963	833	......	......	......	2019	B. I. oil 35 bbls......	167
......	......	2030	832	......	......	......	2104	B. I. oil, 25 bbls......	168
279	928	2050	848	......	......	......	2119	B. I. oil, 5 bbls., now 3......	169
220	911	1975	844	......	......	......	2038	B. I. oil......	170
......	......	1965	825	......	......	......	2044	B. I. oil......	171
......	......	1783	813	......	......	......	1856½	B. I. oil, 10 bbls., now 2......	172
......	......	1760	795	......	......	......	1839	B. I. oil 7½ bbls., now 2......	173
......	......	1910	818	......	......	......	1984	B. I. oil, 5 bbls., now 1......	174
......	......	1856	821	......	......	......	1918	B. I. oil, 15 bbls., now 3......	175
......	......	......	......	......	......	......	......	B. I. oil, 3-5 bbls., now 1......	176
......	......	......	......	......	......	......	......	B. I. oil, 6-8 bbls., now 4......	177
72	928	1856	856	......	......	......	1904	B. I. oil, 12 bbls., now 5......	178

Summarized Record of Oil and Gas

No. on Map II.	FARM NAME, LOCAL WELL AND NUMBER	Magisterial District.	OWNER	Elevation Above Tide
179	Jas. Connell Heirs No. 7	Union (Clay)	Birch Run	950B
180	Jas. Connell Heirs No. 5	Union (Clay)	Birch Run	1025B
181	Jas. Connell Heirs No. 8	Union (Clay)	Birch Run	1220B
182	Jas. Connell Heirs No. 9	Union (Clay)	Birch Run	1190B
183	Jas. Connell Heirs No. 10	Union (Clay)	Birch Run	970B
184	Jas. Connell Heirs No. 1	Union (Clay)	Birch Run	950B
185	Jas. Connell Heirs No. 6	Union (Clay)	Birch Run	1210B
186	Jas. Connell Heirs No. 3	Union (Clay)	Birch Run	1180B
187	Jas. Connell Heirs No. 4	Union (Clay)	Birch Run	1020B
188	P. N. King No. 2	Union (Clay)	Chalmers O. & G.	1020B
189	Connell Heirs No. 1	Union (Clay)	Raven Carbon	1140B
190	D. R. King No. 1	Union (Clay)	Public O. & G.	945B
191	Thos. King No. 1	Union (Clay)	Public O. & G.	1225B
192	W. H. Evans No. 1	Union (Clay)	Eastern Carbon	1000B
193	Harrison Samples Heirs No. 2	Union (Clay)	Clay County	844L
194	W. D. Samples No. 1	Union (Clay)	Public O. & G.	847L
195	W. D. Samples No. 2	Union (Clay)	Public O. & G.	885B
196	W. H. Evans No. 2	Union (Clay)	Eastern Carbon	1160B
197	R. P. Cogar No. 1	Union (Clay)	Public O. & G.	1130B
198	Mary Samples	Union (Clay)	Eastern Carbon	805B
199	P. S. Hart No. 1	Union (Clay)	Eastern Carbon	965B
200	Samuel Stephenson No. 1	Union (Clay)	United Fuel	1045B
201	P. S. & H. M. Young No. 3	Union (Clay)	Public O. & G.	1035B
202	P. S. & H. M. Young No. 1	Union (Clay)	Public O. & G.	1190B
203	Gardner et al. No. 1	Union (Clay)	Goshorn O. & G.	898L
204	P. S. & H. M. Young No. 2	Union (Clay)	Public O. & G.	1160B
205	Burdett Coal & Land Co. No. 281	Union (Clay)	United Fuel	1045
206	Burdett Coal & Land Co. No. 201	Union (Clay)	Uuited Fuel	1110B
207	J. M. Young No. 3	Union (Clay)	Public O. & G.	1210B
208	J. M. Young No. 1	Union (Clay)	Public O. & G.	1250B
209	Burdett Coal & Land Co. No. 203	Union (Clay)	United Fuel	1180B
210	Princess Land Co. No. 608	Union (Clay)	United Fuel	885B
211	L. D. Graham No. 2	Union (Clay)	Eastern Carbon	1005B
212	J. M. Young (No. 2?)	Union (Clay)	Public O. & G.	1175B
213	L. D. Graham No. 1	Union (Clay)	Eastern Carbon	920B
214	L. D. Graham No. 3	Union (Clay)	Eastern Carbon	1200B
215	Princess Coal Co. No. 1	(Kanawha Co.)	South Penn	655B
216	Guss Carnes No. 1	(Kanawha Co.)	Eastern Carbon	642B
217	Brown, Goshorn & Swan No. 568	(Kanawha Co.)	United Fuel	695B
218	D. E. Taylor No. 1	(Kanawha Co.)	Eastern Carbon	635B
219	Brawley	(Kanawha Co.)	Brawley et al.	660B
220	Scott Young	(Kanawha Co.)	Eastern Carbon	650B
221	Queen Land Co No. 1	(Kanawha Co.)	Raven Carbon	765B
222	Queen Land Co. No. 3	(Kanawha Co.)	Raven Carbon	761B
223	Queen Land Co. No. 2	(Kanawha Co.)	Raven Carbon	690B
224	....	(Kanawha Co.)	Raven Carbon	....
225	Queen Land Co. No. 4	(Kanawha Co.)	Raven Carbon	800B
226	....	....	....	....
227	Davenport et al. No. 1	(Kanawha Co.)	Ohio Fuel	990B
228	L. C. Carnes No. 2	Union (Clay)	Public O. & G.	1325B
228A	L. C. Carnes No. 1	Union (Clay)	Koontz O. & G.	1015B
229	W. D. Carnes No. 1	Union (Clay)	Koontz O. & G.	1005L
230	Geo. King No. 1	Union (Clay)	Koontz O. & G.	955B
231	Porter Creek C. & C. Co. No. 663	Union (Clay)	United Fuel	1255B
232	Homer Stephenson No. 552	Union (Clay)	United Fuel	1140
233	Goshorn Heirs No. 5	Union (Clay)	Little Sycamore	1050B
234	Goshorn Heirs No. 1	Union (Clay)	Little Sycamore	970B
235	Goshorn Heirs No. 2	Union (Clay)	Little Sycamore	985B
236	Goshorn Heirs No. 3	Union (Clay)	Little Sycamore	1015B
237	Goshorn Heirs No. 6	Union (Clay)	Little Sycamore	1050B
238	Goshorn Heirs No. 9	Union (Clay)	Little Sycamore	1320B
239	Goshorn Heirs No. 10	Union (Clay)	Little Sycamore	1295B
240	Goshorn Heirs No. 11	Union (Clay)	Little Sycamore	....
241	Goshorn Heirs No. 7	Union (Clay)	Little Sycamore	1385B
242	Goshorn Heirs No. 8	Union (Clay)	Little Sycamore	1310B
243	Goshorn Heirs No. 4	Union (Clay)	Little Sycamore	....
244	Elk River Lumber Co. No. 1	Union (Clay)	Eldorado O. & G.	1060B
245	Blue Creek Coal & Land Co. No. 658	Union (Clay)	United Fuel	1020B
246	Ohio Lumber Co. No. 2	Union (Clay)	Ohio Fuel	1060B

Wells in Clay County, Continued.

Upper Kittanning Coal (Base)		Big Injun Sand (Top)		Berea Sand (Top)	Gordon Sand (Top)	5th Sand (Top)	Total Depth Feet	PRODUCING SAND AND REMARKS.	No. on Map II
Depth	Eleva. A. T.	Depth	Eleva. B. T.						
....	....	1776	826	....	....	....	1855	B. I. oil, 1 bbl., now 0.6	179
....	....	1850	835	....	....	....	1926	B. I. oil, 40 bbls., now 8	180
....	....	2037	817	....	....	....	2117	B. I. oil, 15 bbls., now 3	181
260	930	2008	818	....	....	....	2085	B. I. oil, 1½ bbls., now 1	182
0	970	1791	821	....	....	....	1838	B. I. gas	183
(—10)	960	....	....	....	....	....	....	Dry	184
305	905	2035	825	....	....	....	2114	B. I. oil, 10 bbls., now 4	185
....	....	....	....	....	....	....	....	B. I. oil, 9 bbls, now 4	186
....	....	....	....	....	....	....	....	B. I. oil, 11 bbls., now 4	187
....	....	....	....	....	....	....	....	B. I. oil; 2 bbls., now 1	188
200	940	1958	818	....	....	....	2038	B. I. oil, 24 bbls., now 2½	189
0	945	1725	780	....	....	....	1758	B. I. gas. Gas ss, & B. Lm. gas.	190
....	....	....	....	....	....	....	....	B. I. gas, 1,500,000′	191
....	....	1720	720	....	....	....	1760	B. I. gas, 2,000,000′	192
....	....	1610	766	....	....	....	1681	B. I. gas, 2,500,000′	193
....	942	1615	768	....	....	....	1648	B. I. gas, 3,000,000′	194
....	....	....	....	....	....	....	....	B. I. gas	195
....	....	....	....	....	....	....	....	B. I. gas, 1,000,000′	196
156	974	1830	700	....	....	....	1862	B. I. gas, 3,500,000′	197
....	....	....	....	....	....	....	....	B. I. gas	198
10	955	....	....	....	....	....	....	B. I. gas, 3,000,000′	199
104	941	1755	710	....	....	....	1777	B. Lm. gas	200
....	....	1737	702	....	....	....	1790	Knr. gas	201
245	945	1856	646	....	....	2620	3000	Knr. gas, 750,000′	202
....	....	1581	683	....	....	....	1705	Knr. & B. I. gas	203
....	....	1895	735	....	....	....	1920	B. I. gas	204
....	....	1700	655	....	....	....	1734	B. I. gas	205
....	....	1755	645	....	....	....	1801	B. I. gas, 1,278,000′	206
....	....	....	....	....	....	....	....	B. I. gas, 2,000,000′	207
305	945	1889	639	....	....	....	2160	Knr. & B. I. gas	208
....	....	1847	667	....	....	....	1877	"Gas" & B. Lm. gas	209
(—25)	910	1561	676	....	....	....	2375	Knr. gas, 3,000,000′	210
....	....	....	....	....	....	....	....	Knr. gas, 8,000,000′	211
....	....	....	....	....	....	....	....	B. I. gas	212
0	920	....	....	....	....	....	....	B. I. gas, 2,000,000′	213
280	920	1898	978	....	....	....	1933	B. I. gas	214
....	....	1404	....	....	....	....	2575	Dry hole	215
....	....	....	....	....	....	....	....	B. I. gas	216
....	....	1409	714	....	....	....	1493	B. I. gas, Salt, oil & gas shows	217
....	....	1364	729	....	....	....	1885	B. I. gas	218
....	....	....	....	....	....	....	....	Gasser	219
....	....	....	....	....	....	....	....	Gasser	220
....	....	....	....	....	....	....	....	Dry hole	221
....	....	....	....	....	....	....	....	B. I. gas	222
....	....	....	....	....	....	....	....	B. I. gas	223
....	....	....	....	....	....	....	....	....	224
....	....	....	....	....	....	....	....	B. I. gas	225
....	....	....	....	....	....	....	....	....	226
....	....	1695	705	....	....	....	2628	B. I. & Weir gas	227
....	....	2063	738	....	....	....	2318	Knr. gas	228
....	....	1810	795	....	....	....	1917	Dry, Knr. gas show	228A
....	....	....	....	....	....	....	977	Salt oil, pumped 3 mos. & abandoned	229
....	....	1770	815	....	....	....	2112	Knr. gas	230
227	1028	2084	829	....	....	....	2485	Knr. gas——190,000′	231
145	995	1948	808	....	....	....	2056	B. I. gas, 1½ million	232
0	1050	1815	765	....	....	....	2828	B. I. gas, 1 million	233
....	....	....	....	....	....	....	918	Salt oil, 10 bbls., now 3	234
....	....	1715	730	....	....	....	1840	B. I. gas, 2 millions; R. P. 520 lbs.	235
....	....	1737	722	....	....	....	1862	B. I. gas, 2 millions; R. P. 520 lbs.	236
....	....	1730	680	....	....	....	1855	B. I. gas, 3½ millions; R. P. 520 lbs.	237
....	....	2114	794	....	....	....	2204	B. I. gas 2½ millions; R. P. 520 lbs.	238
....	....	....	....	....	....	....	....	Dry. B. I. oil show	239
....	....	1870	....	....	....	....	1940	Drilling 10-26-15	240
....	....	2150	765	....	....	....	2428	B. I. gas, 2½ millions; R. P. 520 lbs.	241
215	1095	2085	775	....	....	....	2170	B. I. gas, 1½ millions; R. P. 520 lbs.	242
....	....	....	....	....	....	....	....	Dry	243
....	....	1915	855	....	....	....	1992	B. I. gas made flow oil B. I.	244
....	....	1980	960	2470	....	....	3176	Dry. Gas show B. Lm.	245
....	....	1855	795	....	....	....	2226	Dry. Salt, Knr. & B. I. oil shows	246

In addition to the summarized records in the accompanying table, the detailed logs of the most of these wells will be published on the following pages, giving all the information that is available regarding the underground strata.

DETAILED WELL RECORDS, OTTER DISTRICT (CLAY COUNTY).

Otter District lies in the northern point of Clay County, almost its entire area being situated on the western slope of the Hansford Anticline, the axis of the latter fold and that of the Grassland Syncline just traversing the southeast edge and the northern point respectively. The total structural relief of the surface strata is about 750 feet. Only four wells have been completed within the District, three of which were abandoned as non-paying or dry holes.

The detailed log of the **J. M. Boggs No. 1 well—No. 111 on Map II**—located on the south bank of Otter Creek, 0.6 mile southeast of Big Otter P. O., is published in Chapter IV, pages 107-9, in connection with the section for the latter point. This boring was completed in April, 1911, by the Big Otter Oil & Gas Co., and penetrated to a depth of 696 feet below the top of the Big Injun, finding only **slate and shells** below the latter sand. In October, 1915, it was still making sufficient gas from the Big Injun to supply domestic fuel for 18 families in the immediately surrounding region, according to J. M. Boggs. The two following records are from wells in that region:

R. S. Hamrick No. 1 Well Record (No. 110 on Map II).

Otter District, Clay County, on north bank of Otter Creek, 0.4 mile southwest of Big Otter; authority, Big Otter Oil & Gas Co.; completed, 1911; elevation, 865′ B.

	Top. Feet.	Bottom. Feet.
Sand, Upper East Lynn (water at 490′)	320	535
Coal, Stockton	535	538
Sand	545	730
Lime	770	792
Sand	846	1010
Sand, Rosedale Gas	1022	1084
Sand, Rosedale Salt (water at 1200′, 1292′ and 1555′)	1155	1690
Little Lime	1695	1715

	Top. Feet.	Bottom. Feet.
Pencil Cave	1715	1716
Big Lime	1720	1786
Sand, Big Injun	1786	1814
Total depth		1879

10" casing, 193'; 8¼" casing, 1320'.

As shown by the structure contours on Map II, the above boring starts about 320 feet above the horizon of the Upper Kittanning Coal, so that the great sandstone mass at 320 feet evidently represents the coalition of the Upper East Lynn, East Lynn, and Homewood ledges. The well was abandoned as a dry hole, not a single show of oil and gas being recorded.

J. G. Lyons No. 1 Well Record (No. 112 on Map II).

Otter District, Clay County, on north bank of Rush Run, 2.3 miles south of Big Otter; authority, Dr. T. D. Nutter; drilled by the Ivydale Oil & Gas Co.; completed, July, 1912; elevation, 865' B.

	Top. Feet.	Bottom. Feet.
Sand	17	203
Coal, No. 5 Block (water at 203')	203	206
Slate	206	209
Sand, Second Cow Run	217	333
Slate	333	351
Sand	351	400
Coal, Coalburg	408	410
Sand	432	496
Lime shells	496	635
Sand	635	820
Sand, Rosedale Gas	838	955
Coal, Sewell?	1000	1006
Lime	1006	1020
Sand, Rosedale Salt (water at 1080')	1020	1100
Sand (water at 1300'; show of gas at 1220'; show of green oil, 1323')	1140	1408
Slate	1408	1434
Shale, red	1434	1456
Little Lime	1476	1522
Slate	1522	1548
Pencil Cave	1548	1560
Big Lime	1560	1675
Sand, Big Injun	1675	1700
Total depth (black shale)		1800

10" casing, 100'; 8¼" casing, 1310'.

According to C. D. Underwood of Ivydale, the oil pay in the Salt Sand at 1323 feet showed for about 15 barrels daily. The well mouth is about 120 feet above the horizon of the Upper Kittanning Coal.

The **Mollohan & Dickenson No. 1 well—No. 113 on Map II**—located in the southeastern point of Otter District (Clay) at the mouth of Road Fork of O'Brien Creek, was completed 14 to 15 years ago by Fred Paul Grosscup of Charleston, West Virginia, to a depth of about 2600 feet without finding oil or gas in paying quantities. The Survey did not obtain the log of this boring, since Mr. Grosscup was unable to find its record, but it starts almost flush with the horizon of the Upper Kittanning, so must have encountered the top of the Big Injun at a depth of about 1500 feet and therefore penetrated below the horizon of the Fifth or McDonald Sand.

PROSPECTIVE OIL AND GAS AREAS, OTTER DISTRICT (CLAY COUNTY).

The results of these four test wells in Otter District have not been encouraging from an oil and gas standpoint. However, there are some scattered areas, specially favored by structure, that warrant mentioning. (1) That in the northern point of the District in the low structural basin to the west of the 1075-foot contour of the Pittsburgh Coal as limited on Map II, appears favorable for oil in the non-water-bearing zones which lie below the Big Injun, but the results of most of the wells in the surrounding region indicate the absence of sands below the latter in the Catskill Series, with the exception of the **W. G. Bennett No. 2—No. 89 on Map II**—the log of which, given on a preceding page, records 15 feet of Berea and the same amount of Fifty-foot Sand. (2) The Big Injun showing of gas encountered in the **J. M. Boggs No. 1 well—No. 111 on Map II**—described on preceding pages of this Chapter, indicates that the sands are not entirely barren. A test well located 3¾ miles northeastward on the head of Boggs Fork on the slight structural terrace formed by the fading away of the Sleith Fork Anticline appears more favorable for results in the same sand than the Boggs well, but it would probably be fruitless to drill below the Big Injun in this region, owing to the absence of the Berea and sands of the Catskill Series in the records of wells in the adjoining portion of Birch District (Braxton). (3) That region in the southern edge of Otter District, lying immediately along the crest of the Hansford Anticline, should warrant a test for gas in the Big Injun and higher sands.

DETAILED WELL RECORDS IN BUFFALO DISTRICT (CLAY COUNTY).

Buffalo District occupies the eastern corner of Clay County, its area being traversed by the Hansford and Standing Rock Anticlines and the Handley Syncline. By far the greater portion of it, however, lies on the southeast slope of the latter fold. The Upper Kittanning Coal horizon rises from slightly less than 800 feet above sea-level near Villa Nova to over 1700 feet above the same datum in the southern point of the District, giving a total structural relief in the surface strata of about 900 feet. Only two wells have been completed within the District and both of these were dry holes. The two following records are from these borings:

Elk River Coal & Lumber Co. No. 1576 Well Record (No. 114 on Map II).

Buffalo District, Clay County, on Rockcamp Run, 2.1 miles northwest of Widen; drilled by Hope Natural Gas Co.; authority, J. G. Bradley and United Fuel Gas Co.; completed, February 17, 1911; elevation, 1215' L.

	Thickness. Feet.	Total. Feet.
Unrecorded	132	132
Coal, Coalburg	3	135
Unrecorded	62	197
Coal, Winifrede	15	212
Unrecorded	313	525
Sand, Rosedale Gas (gas at 785')	275	800
Lime	75	875
Shale	50	925
Sand, Rosedale Salt	115	1040
Shale	40	1080
Sand, Second Salt	80	1160
Slate	60	1220
Sand, Maxton?	60	1280
Unrecorded	117	1397
Sand (water at 1438')	81	1478
Unrecorded	77	1555
Pencil Cave	5	1560
Lime and shale, **Big Lime**	100	1660
Unrecorded	6	1666
Pencil Cave	28	1694

	Thickness. Feet.	Total. Feet.
Sand, Big Injun (gas at 1772'-1777')	270	1964
Red rock	26	1990
Shells	40	2030
Lime, sandy	150	2180
Unrecorded	34	2214
Shale	186	2400
Lime, sandy	35	2435
Shale	345	2780
Lime, sandy	210	2990
Unrecorded	364	3354

The above well starts 25 feet by hand-level below an opening in the No. 5 Block Coal as determined by the writer, and has been abandoned as a dry hole.

Elk River Coal & Lumber Co. No. 1341 Well Record (No. 115 on Map II).

Buffalo District, Clay County, on northeast side of Dog Run, 0.6 mile southeast of mouth of Little Dog Run; drilled by the Hope Natural Gas Co.; authority, J. G. Bradley and United Fuel Gas Co.; completed, 1909; elevation, 1150' B.

	Thickness. Feet.	Total. Feet.
Conductor	18	18
Lime, hard, probably Kanawha Black Flint	4	22
Coal, Stockton	3	25
Sand	55	80
Coal, Coalburg (hole full of water at 80')	5	85
Sand (water at 150')	96	181
Slate	20	201
Lime	15	216
Slate, black	22	238
Lime	7	245
Slate, black	5	250
Lime	55	305
Lime, sandy	45	350
Slate, black	40	390
Lime, brown	50	440
Slate, black	4	444
Lime, sandy	146	590
Slate, black	25	615
Lime, sandy	17	632
Sand	28	660
Slate, black	20	680
Sand, Rosedale Gas	100	780
Slate, black	20	800
Lime	20	820
Slate	15	835
Lime	10	845
Sand, Rosedale, (2 bailers water at 940')	130	975
Slate, black	10	985

	Thickness. Feet.	Total. Feet.
Sand	140	1125
Slate, black	13	1138
Sand, Salt (2 bailers water at 1202')	92	1230
Slate, black	90	1320
Lime	60	1380
Sand, Maxton	45	1425
Red rock	25	1450
Lime	30	1480
Red rock	20	1500
Sand, hard, gray, (**gas** at 1575')	85	1585
Slate and shells, (some **gas and oil** at 1583')	40	1625
Lime and sand, (show of oil at 1645')	20	1645
Slate, black	15	1660
Lime	20	1680
Slate, black	16	1696
Pencil Cave	51	1747
Big Lime	194	1941
Red rock (some **gas** at 1950')	22	1963
Slate, white	164	2127
Lime, hard	10	2137
Slate, white	7	2144
Lime, shelly	26	2170
Slate, white	20	2190
Lime, soft	110	2300
Shells and slate	40	2340
Slate	35	2375
Lime, shelly, hard	13	2388
Slate, brown	77	2465
Slate and shells	315	2780
Lime, hard	20	2800
Lime, brown	100	2900
Slate and lime	129	3029
Lime, hard	21	3050
Lime shells	200	3250
Lime	50	3300
Slate and shells	120	3420
Slate and lime	155	3575
Slate and shells to bottom	135	3710

13" casing, 226'; 10" casing, 1194½'; 8¼" casing, 1745'; 5 3/16" casing, 3029'.

The above well was abandoned as a dry hole. It starts about 240 feet below the horizon of the Upper Kittanning Coal and about 100 feet below that of the No. 5 Block bed, and, like the preceding well, penetrated entirely through the Catskill Series without finding any sands below the Big Injun.

The detailed log of the **Elk River Coal & Lumber Company No. 1553 Well—No. 116 on Map II**—located in Nicholas County on the east bank of the Road Fork of Strange Creek, 1.3 miles southeast of Dille, is published in Chapter IV, pages

115-117, in connection with the Widen—3 Miles Northeast Section. This well did not penetrate below the Big Injun and its log does not record a showing of either oil or gas.

The following is a record of a dry hole in Nicholas County on the southeast side of Powell Mountain, the horizon of the well mouth not being determined. At **Well No. 116 on Map II,** described above, the top of the Big Injun Sand comes 1740 feet below the No. 5 Block Coal, so that the McQueen well evidently starts below the latter bed, if allowance be made for the continued rapid rate of southeast expansion of the Pottsville and Mauch Chunk Series:

McQueen No. 1 Well Record (No. 117 on Map II).

In Nicholas County, on north bank of Brushy Fork of Muddlety Creek, 4.9 miles southeast of Clay-Nicholas Line, 0.9 mile northeast of Hookersville; authority, E. A. Mead; completed about 1912; elevation, 1870′ B.

	Thickness. Feet.	Total. Feet.
Clay, yellow	5	5
Slate, black	6	11
Coal	2	13
Slate and shells	267	280
Sand, white	190	470
Slate, black	15	485
Sand, white	115	600
Coal	5	605
Sand, white	20	625
Slate, black	175	800
Coal (2 bailers water)	4	804
Slate	5	809
Coal	5	814
Sand, white, (100,000 cu. ft. gas at 830′; 10 bailers water per hour at 835′)	16	830
Sand, dark	25	855
Slate, black	15	870
Sand, white	5	875
Red rock	245	1120
Slate and shells	130	1250
Red rock	190	1440
Sand, gray	60	1500
Slate, black	60	1560
Lime	30	1590
Slate and shells	110	1700
Lime	20	1720
Slate, black (Pencil)	30	1750
Big Lime	110	1860
Sand, Big Injun (a little gas)	65	1925
Slate and shells	125	2050
Sand, gray, (show of oil at 2110′)	125	2175
Slate and shells to bottom	625	2800

PROSPECTIVE OIL AND GAS AREAS, BUFFALO DISTRICT, (CLAY COUNTY).

The results of the tests in the southeast half of Buffalo District and the immediately adjoining portion of Nicholas County have been of a discouraging nature, this region lying on the steep southeast slope of the Handley Syncline, with no prominent break or flattening of the northwest dip of the strata to cause a segregation of any of the oil and gas that the sands might contain into commercial pools. In the northwest portion of the District, different structural conditions prevail, since here the Hansford and Standing Rock Anticlines and the Handley Syncline are prominent features. (1) That portion of the District lying on the wide flat structural terrace northward from the 1000-foot contour of the Upper Kittanning Coal that passes through Bragg Knob and lies westward from Groves Creek is favorably located from a purely structural standpoint for oil in the Big Injun and higher sands, those below the former down to the base of the Catskill Series probably being absent in this region. However, the absence of gas in paying quantities southeastward higher up the structural slope at **Wells Nos. 114, 115, and 116 on Map II,** all of which have been described above, tends to increase the financial risk involved in sinking a test well in this region. (2) That area in the northwest corner, lying immediately along the crest of the Standing Rock Anticline, is perhaps as favorably located for gas in the same zones. Of course, it should be kept in mind that in this portion of the State, structure contours on surface strata are not nearly so reliable as in the northern counties in determining the lay of the Big Injun and deeper sands, due to the very rapid southeast expansion of the Pottsville and Mauch Chunk Series, and it is very probable that, if the contours were on top of the Big Injun, there would result a much more pronounced structural basin than indicated on Map II for the Handley Syncline, the axis of which would probably lie 1 to 2 miles southeast of that of the latter fold as indicated on the Map in question.

DETAILED WELL RECORDS IN HENRY DISTRICT (CLAY COUNTY).

Henry District extends in a northwest-southeast direction entirely across the middle portion of Clay County, its area being traversed by the Grassland and Handley Synclines and the Hansford Anticline. Only 7 wells have been drilled for oil and gas within the District, 4 on the north side of Elk River and 3 on the south side, all of which proved fruitless from a commercial standpoint. The detailed log of the **W. C. Tallman No. 1 well—No. 120 on Map II**—located in the extreme northwest edge of Henry District on the west bank of Charleston Fork, 0.5 mile southeast of Wallback P. O. and completed by the Elk River Oil & Gas Company on May 20th, 1901, is published in connection with the section for the latter place on pages 121-122 in Chapter IV. No oil was found and only a show of gas encountered, this occurring in the Big Injun. The well penetrated to a depth of 1331 feet below the top of the Big Injun and found only one sand below the latter, probably the Fifth. It is recorded 25 feet in thickness, 730 feet below the top of the Big Injun. This well is located just east of the axis of the Grassland Syncline. The axis of the latter fold dips northeastward quite rapidly, the following being the record of a well 1½ miles in this direction, just on the west side of the axis, the details of which were kindly furnished the Survey by Thos. E. Mobley, General Superintendent of the Carter Oil Company:

Brooks Boggs No. 1 Well Record (No. 118 on Map II).

Roane County, on Right Fork, 1.2 miles northeast of Wallback and 0.5 mile northwest of the Roane-Clay Line; drilled by Carter Oil Company; completed in 1915; elevation, 800′ L.

	Thickness. Feet.	Total. Feet.
Clay and gravel	24	24
Slate	159	183
Sand	25	208
Sand and slate (fresh water at 245′)	172	380
Sand, Homewood, Second Cow Run	85	465
Slate and sand	785	1250
Sand, Salt (Lower), (no water)	30	1280
Slate and lime	180	1460
Sand, Maxton (fresh water at 1495′)	40	1500

	Thickness. Feet.	Total. Feet.
Red rock and slate	82	1582
Little Lime	48	1630
Pencil Cave	20	1650
Big Lime (salt water at 1786'; very small show of gas at 1716')	191	1841
Slate	304	2145
Shale, brown	15	2160
Slate and lime to bottom	647	2807

10" casing, put in well, 230'; pulled out, 230'; 8" casing, put in well, 700'; pulled out, 700'; 6⅝" casing, put in well, 1676'; pulled out 1594½'.

The above well starts about 320 feet above the horizon of the Upper Kittanning Coal and 450 to 460 feet below that of the Pittsburgh bed and penetrated to a depth of 966 feet below the base of the Big Lime (Greenbrier Limestone) without finding any sand, the Big Injun even being absent. The well was abandoned as a dry hole, since no oil was found and only a show of gas encountered in the Big Lime.

The detailed log of the **J. M. Gross No. 1 well—No. 121 on Map II**—located at the mouth of Hansford Fork of Laurel Creek in Henry District (Clay) and completed by the Elk River Oil & Gas Company about 15 years ago, is published in Chapter IV in connection with the Valley Fork-1 Mile Southwest Section, pages 124-125. This well was abandoned as a dry hole through the horizon of the Fifth Sand, since only a show of gas was found, this occurring in the Big Injun.

In the same District, the following is the record of a well slightly over one-half mile west of the axis of the Hansford Anticline that starts 110 feet below the Upper Kittanning Coal. Oil and gas shows were encountered in the Rosedale Gas and Salt Sands and Big Injun Sand, but evidently not in sufficient quantity to justify the building of pipe-lines into the region at that time, since it was finally abandoned:

Richard Shelton No. 1 Well Record (No. 122 on Map II).

Henry District, on Laurel Fork, ½ mile west of Maysel; well by Elk River Oil & Gas Co.; authority, H. B. Davenport; completed, March 28, 1902; elevation, 915' B.

	Thickness. Feet.	Total. Feet.
Surface and gravel	40	40
Coal, "No. 5 Block"	2	42

			Thickness. Feet.	Total. Feet.
Sand, Homewood			68	110
Shale	(615')		415	525?
Sand, Rosedale Gas (gas at 750')			75	800
Slate			50	850
Sand, Rosedale Salt (oil and gas at 865'; some water, 925'; big water, 965')			160	1010
Lime			30	1040
Sand	75'	Salt Sand	284	1324
Slate	25			
Sand	60			
Lime	10			
Sand (big crevice in sand.)	40			
Slate	26			
Sand, (oil at 1285')	48			
Slate			11	1335
Red rock			15	1350
Lime			15	1365
Sand, Maxton			45	1410
Lime shells	(40)		90	1500
Pencil Cave			20	1520
Big Lime			114	1634
Sand, Big Injun			38	1672
Unrecorded to bottom			8	1680

Little gas at 1636'; oil and gas at 1648'; break going into blue sand at 1656'; 13" casing, 40'; 10" casing, 107'; 8¼" casing, 507'; 6⅝" casing, 1250'; 5 3/16" casing, 1520'.

There is a discrepancy in the above well record, in that two results—615 and 415 feet—were given for the thickness of the shale member at 110 feet from the top. The totals had been carried out on the basis of 415, but it is probable that 615 feet should have been used, since the following record of another well two miles due southward in the same District gives 1890 feet for the interval between the Upper Kittanning Coal and the top of the Keener Sand, as against 1744 for the same interval in the Shelton well:

Geo. W. Butcher No. 1 Well Record (No. 123 on Map II).

Henry District, on branch of Blue Knob Creek, 2 miles west of Clay; well by Blue Knob Oil & Gas Co.; authority, H. B. Davenport; completed, August 17, 1912; elevation, 1020' B.

	Thickness. Feet.	Total. Feet.
Conductor	16	16
Sand. hard, East Lynn	74	90
Coal, "No. 5 Block"	2	92
Sand, Homewood and Upper Coalburg	158	250
Coal, Coalburg	3	253
Sand	247	500

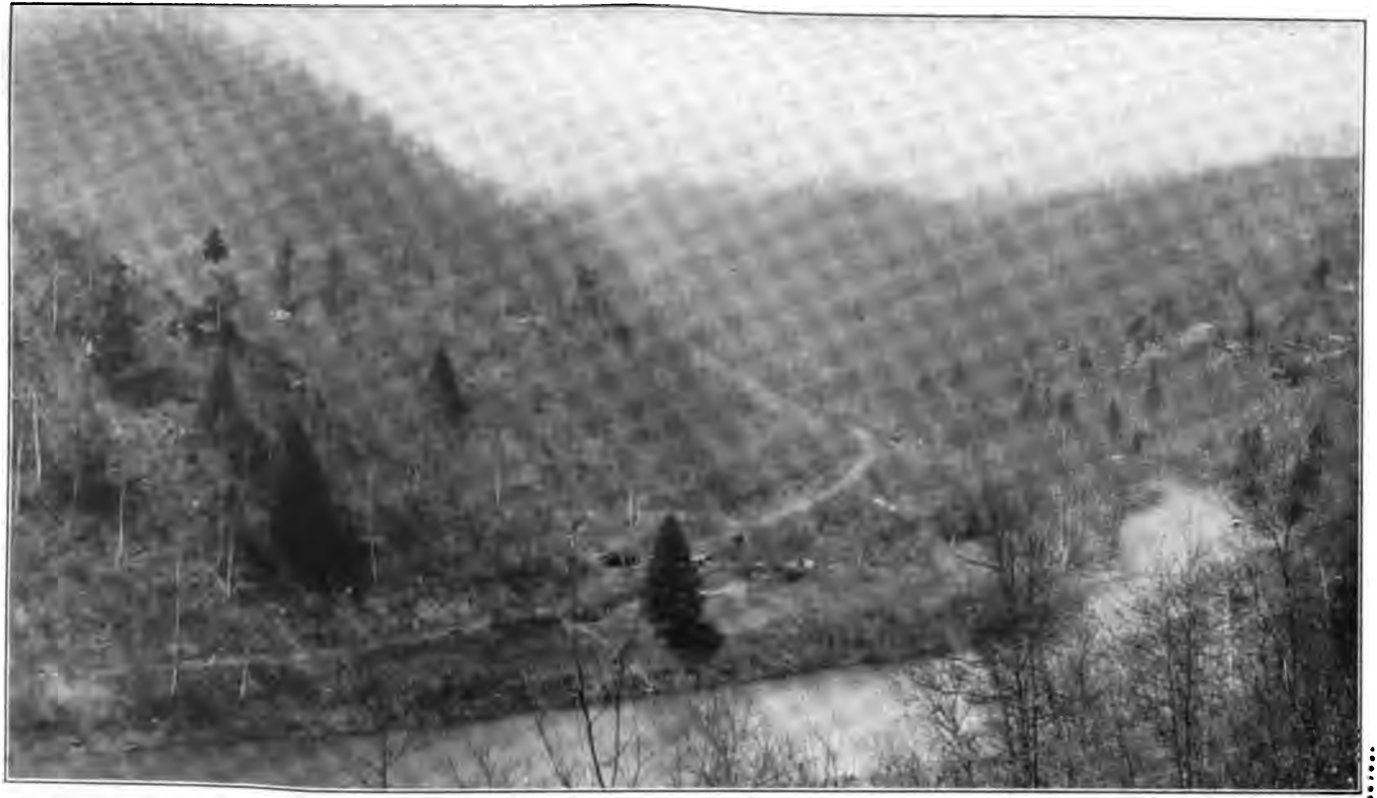

PLATE XIV.—Showing topography of Allegheny Series and Kanawha Group along Elk River westward from Groves, Clay County.

	Thickness. Feet.	Total. Feet.
Slate	15	515
Sand	185	700
Shale	50	750
Sand, Rosedale Gas (2 bailers water at 835'; oil at 890')	200	950
Lime, sandy	100	1050
Sand, Rosedale Salt	210	1260
Slate and shells	115	1375
Sand, Salt (bailer full of water at 1465')	100	1475
Lime	10	1485
Red rock	15	1500
Lime	80	1580
Sand, blue	17	1587
Little Lime	48	1645
Pencil Cave	10	1655
Big Lime	150	1805
Sand, Keener	6	1811
Lime, white	4	1815
Sand, Big Injun	20	1835
Slate, break	2	1837
Sand, blue	3	1840
Red rock to bottom	12	1852

2 bailers water at 1100'; also at 1200'; gas at 1250'; 8¼" casing, 470'; 6⅝" casing, 1661'.

The above well starts about 85 feet below the Upper Kittanning Coal as determined by the writer and it was abandoned as a dry hole, since only a show of oil was encountered, this occurring in what appears to be the Rosedale Gas Sand.

The detailed log of the **Jacob Tome Institute No. 1 well—No. 124 on Map II**—located on the south bank of Elk River, 0.2 mile north of the mouth of Pisgah Run, is published in connection with the Clay Section, pages 129-132. Shows of oil and gas were encountered in the Big Injun, but not in sufficient quantity to pay, so the well was abandoned. Although it penetrated to a depth of 795 feet below the top of the Big Injun, only 5 feet of broken sand, 720 feet below the same datum, was found, this probably representing the Gordon.

The detailed log of the **Elk River Coal & Lumber Co. No. 1865 well—No. 125 on Map II**—located 4 miles southeast of Clay in Henry District on the north bank of Sinnett Branch of Lilly Fork and completed by the Hope Natural Gas Company on February 4, 1911, is published in Chapter IV in connection with the Sinnett Branch Section, pages 135-136. No sand was found below the Big Injun, although the boring penetrated to a depth of 1429 feet below the latter zone. The well was abandoned as a dry hole, since no oil or gas was found.

The following is the record of a light gas well from the base of the Big Lime, completed June 5, 1916, the details of which were kindly furnished the Survey by H. B. Davenport and C. E. Krebs. According to the former, it starts 35 feet below the Stockton Coal, the latter seam in this immediate region being described at an opening just east of the well on a subsequent page in Chapter X:

Davenport & Elliott No. 1 Well Record (No. 124A on Map II).

Henry District, 3¼ miles due south of Clay, at forks of Devils Den Branch of Leatherwood Creek; by Hartland Oil and Gas Company; elevation, 850′ B.

	Thickness. Feet.	Total. Feet.
Conductor (surface gravel and coal)	16	16
Coal, Coalburg	4½	17½?
Sand	92½	110
Slate	1	111
Sand	12	123
Coal, Winifrede?	4	127
Sand	73	200
Lime	5	205
Coal, Chilton?	2	207
Slate	10	217
Sand	53	270
Slate	15	285
Sand	25	310
Slate	90	400
Sand	13	413
Coal, No. 2 Gas?	3	416
Slate	50	460?
Sand, (little gas at 478′)	90	550
Slate	50	600
Lime	10	610
Gas Sand, Rosedale (slate break at 702-4′; gas show at 710′)	157	767
Slate	6	773
Lime	27	800
Sand	18	818
Slate	2	820
Lime	11	831
Slate	11	842
Lime	11	853
Slate	22	875
Lime	15	890
Slate	6	896
Lime	20	916

	Thickness. Feet.	Total. Feet.
Salt Sand, Rosedale (8 bailers water between 920' and 950'; slate breaks at 970'-982'; 988-994'; and hole full of water at 950')	129	1045
Slate	5	1050
Lime	45	1095
Sand	70	1165
Slate, lime and shells	155	1320
Sand, black	17	1337
Slate	4	1341
Sand, very hard, to base of Pottsville, (1½ bailers of water at 1405')	69	1410
Red rock	145	1555
Lime	5	1560
Slate	50	1610
Lime	12	1622
Slate, shells and Pencil Cave, (bad cave at 1660-1680')	58	1680
Big Lime, (gas at 1825'-1835', 60,000' daily; oil show at 1805')	160	1840
Big Injun Sand	35	1875
Red rock	20	1895
Slate, shells and lime	299	2194
Berea shells, light oil show	6	2200
Slate, shells and lime	358	2558
Shells, Gordon sand horizon	12	2570
Lime to bottom of hole	30	2600

10" casing, 213'; 8¼" casing, 1060' and 6⅝" casing, 1681½'; steel line.

"After the well was shot with 30 qts. at 1826-1836', it made 200,000 cubic feet of gas daily."

According to Mr. Davenport, the above well will be tubed and its gas supply saved for fuel to drill additional wells in the region.

On August 19, 1916, Mr. Davenport sent the following results for the above well from tests made for the Hartland Oil and Gas Company by Donald B. Hogg, an employee of the United Fuel Gas Company:

"Test of gas well on Devils Den Run on tract of 9190 acres of land in Henry District, Clay County, West Virginia, oil and gas in which is owned by Davenport & Elliott, made August 18, 1916. Well drilled in June, 1916.

"Test made with water gauge through two-inch tubing. Rock pressure, 410 lbs.

"After blowing well five minutes gauge showed 22/10, equivalent to 221,360 cubic feet gas per day.

"After well was blown open one hour, the following minute pressures were taken:

1 minute	25 lbs.	7 minutes	140 lbs.
2 minutes	55 lbs.	8 minutes	150 lbs.
3 minutes	80 lbs.	9 minutes	165 lbs.
4 minutes	95 lbs.	10 minutes	180 lbs.
5 minutes	110 lbs.	30 minutes	295 lbs.
6 minutes	125 lbs.	33 minutes	300 lbs.

"After blowing one hour the water gauge showed 12/10, equivalent to 174,475 cubic feet gas per day."

The following is the detailed log of a well completed on February 19, 1917, that starts about 200 feet below the horizon of the Upper Kittanning Coal, the results being furnished the Survey by C. L. Voglesang:

Davenport & Elliott No. 2 Well Record (124B on Map II).

Henry District, on Devils Den Branch of Leatherwood Creek, 3.7 miles south 15° east of Clay, and about 1 mile southeast of No. 124A; by Price-Hall Oil Co. ?

	Thickness. Feet.	Total. Feet.
Conductor	28	28
Sand	52	80
Coal, Stockton?	3	83
Lime	5	88
Sand	48	136
Coal, Coalburg?	4	140
Lime	10	150
Slate	20	170
Black slate	35	205
Coal, Winifrede?	5	210
Slate	5	215
Sand	70	285
Slate	5	290
Sand	88	378
Slate	17	395
Sand	45	440
Black slate	40	480
Lime	20	500
Sand	35	535
Slate	30	565
Slate and shells	50	615
Lime	20	635
Slate	59	694
Coal	4	698
Slate	72	770
Coal	4	774
Slate and shells	31	805
Gas Sand	95	900
(2 bailers water every 24 hours, 885 feet).		
Slate	5	905
Sand	25	930
Black slate	20	950
Lime	20	970
Sand	25	995
Slate and shells	80	1075
Salt Sand, very hard	127	1202
Slate	2	1204
Red sand (2 bailers of water each 2 hours, 1115 feet)	18	1222
Sand, white	48	1270
Black slate	90	1360
Lime	20	1380

	Thickness. Feet.	Total. Feet.
Sand	28	1408
Black slate	92	1500
Second Salt Sand	95	1595
"Water with gas about 2000 feet each 24 hours of gas; two bailers of water each 2 hours at 1538 feet.		
"At 1582 feet, estimated two and one-half million feet of gas with hole filling up with water."		
Red rock	90	1685
Sand	12	1697
White slate, bad cave, had to case it off	23	1720
Lime	5	1725
Slate, broken, with lime shells	25	1750
Red rock	15	1765
Maxton Sand	6	1771
Red rock	35	1806
Lime	14	1820
Slate, with Pencil Cave	15	1835
Little Lime	30	1865
Pencil Cave	23	1888
Big Lime	196	2084
Slate	16	2100
Red rock	16	2116
Big Injun Sand	12	2128
Slate and shell	402	2530
Berea Sand	16	2546
Slate to bottom	6	2552

Casing record, (all pulled out): 10", 314'; 8¼", 1204'; 6⅝", 1720'; 5 3/16" liner, 170'.

The two following records are from dry holes drilled across the line from Henry District on the northwest edge of Nicholas County, the first of which starts 75 feet below the Kanawha Black Flint ledge as determined by the writer:

Elk River Coal and Lumber Co. No. 1340 Well Record (No. 127 on Map II).

Nicholas County, on north bank of Jim Young Fork, ¼ mile southeast of Clay-Nicholas Line; drilled by the Hope Natural Gas Company; authority, J. G. Bradley and the United Fuel Gas Company; completed in 1909; elevation, 1385' B.

	Thickness. Feet.	Total. Feet.
Conductor and gravel	28	28
Sand, (hole full of water)	21	49
Coal, Winifrede	2	51
Lime	10	61
Sand	44	105
Lime	17	122
Slate	3	125
Coal, Chilton	2	127

	Thickness. Feet.	Total. Feet.
Lime	35	162
Coal, Williamson?	2	164
Lime	36	200
Lime, black	15	215
Sand	10	225
Lime	35	260
Sand	15	275
Lime	25	300
Slate	5	305
Lime	30	335
Sand	22	357
Lime	18	375
Slate	10	385
Lime	32	417
Slate	27	444
Lime	31	475
Sand	10	485
Slate	20	505
Lime	159	664
Coal, Eagle?	2	666
Sand	68	734
Slate	10	744
Sand	11	755
Slate	10	765
Lime	10	775
Slate	10	785
Lime	10	795
Slate	5	800
Lime	15	815
Slate	5	820
Lime	20	840
Slate	10	850
Sand, Rosedale Gas ?	40	890
Coal, Sewell? (1 bailer water per hour at 950')	2	892
Sand, Rosedale Salt?	78	970
Slate	90	1060
Lime	20	1080
Sand	60	1140
Slate	60	1200
Sand	90	1290
Lime	35	1325
Slate	85	1410
Lime	30	1440
Slate	5	1445
Sand	55	1500
Red rock	60	1560
Lime	25	1585
Red rock	25	1610
Lime	10	1620
Slate	5	1625
Lime	5	1630
Slate	10	1640
Sand	30	1670
Slate	20	1690
Lime	10	1700
Slate	5	1705

	Thickness. Feet.	Total. Feet.
Sand	20	1725
Slate	40	1765
Lime	25	1790
Slate	25	1815
Pencil Cave	13	1828
Big Lime	215	2043
Red rock	22	2065
Slate	25	2090
Lime, gritty	30	2120
Slate	140	2260
Slate and shells	360	2620
Lime	480	3100
Slate and shells to bottom	215	3315

13" casing, 171'; 10" casing, 1102½'; 8¼" casing, 1784½'; 6⅝" casing, 1894' 7".

The above log does not record any sand below the Big Lime, although the boring penetrated 1272 feet below the base of the latter. The base of the Pottsville probably comes at 1500 feet, or making the total thickness of the latter Series here about 1700 feet. Not a show of oil or gas is recorded.

Elk River Coal & Lumber Co. No. 1577 Well Record (No. 127A on Map II).

Nicholas County, on head of Beech Fork of Lilly, 1 mile southeast of mouth of Libertybowl Branch; drilled by the Hope Natural Gas Company; authority, J. G. Bradley and the Unitel Fuel Gas Company; approximate elevation, 1550' A. T.

	Thickness. Feet.	Total. Feet.
Unrecorded	87	87
Coal	3	90
Unrecorded	115	205
Sand	40	245
Unrecorded	65	310
Coal	3	313
Unrecorded	162	475
Sand	105	580
Slate	100	680
Sand	110	790
Slate, black	60	850
Sand	50	900
Slate	60	960
Sand	105	1065
Slate	35	1100
Sand	175	1275
Slate	115	1390
Lime	120	1510
Red rock	150	1660
Slate	80	1740

	Thickness. Feet.	Total. Feet.
Lime	25	1765
Sand	35	1800
Slate	40	1840
Cave to bottom	25	1865

13" casing, 29'; 10" casing, 554'; 8¼" casing, 1495'; 6⅝" casing, 1854'.

The above well is located 2½ miles southeast of **No. 127 on Map II**—previously described—and it does not appear to have penetrated to the Big Lime. The well was not visited in the field, so the horizon of the well mouth was not determined. It was abandoned as a dry hole, not a show of oil or gas being recorded in the log.

PROSPECTIVE OIL AND GAS AREAS, HENRY DISTRICT (CLAY COUNTY).

With the exception of the well last described, all the tests for oil and gas thus far completed in Henry District have been of a negative nature as may be readily seen in the foregoing pages. There are at least three different areas within the District, however, that appear to be specially favored for gas or oil from a purely structural standpoint. (1) That region lying along the crest of the Hansford Anticline northeastward from Maysel to the Henry-Otter District Line is ideally located for gas, the Big Injun and higher sands being the most probable productive zones, since those lying deeper appear to be too irregular and uncertain; (2) that, on the structural terrace outlined by the wide divergence of the 1150- and 1175-foot contours of the Upper Kittanning Coal (See Map II) northeastward from Leatherwood Creek to near Sand Fork station on Buffalo Creek, for possible oil or gas in the same sands; and (3) that, on the structural terrace outlined by the wide divergence of the 1225- and 1275-foot contours of the same coal (See Map II) northeastward from Leatherwood Creek, for oil or gas in the Big Injun and higher Sands. However, the results found in Well No. 124B on Devils Den Branch are not encouraging, except that the Berea Sand has made its appearance and may be productive at the mouth of Right Fork of Leatherwood Creek.

In that portion of the District lying to the southeast of the 1275-foot contour of the Upper Kittanning Coal, the dip of the strata is fairly rapid to the northwest as exhibited on Map II. A test well located at the mouth of Road Fork of Leatherwood should reach the Big Injun at a comparatively shallow depth, since it would start about 550 feet below the horizon of the coal last mentioned. The only thing in its favor for gas would be its comparatively high structural level. It should be kept in mind that the southeastern edge of Clay County is approaching the region of the State where the coals have a high fixed carbon content—above 70 per cent.—and are consequently low in volatile matter. The same causes that produced these features—intense folding and necessarily increased metamorphic action—may have led to the escape of the valuable hydrocarbons, petroleum and natural gas.

DETAILED WELL RECORDS IN PLEASANT DISTRICT, CLAY COUNTY.

Pleasant District, occupying the southern point of Clay County, is traversed in a northeast-southwest direction by the Hansford Anticline and the Handley Syncline, as exhibited by the Upper Kittanning Coal contours on Map II, the former fold making only a slight monoclinal interruption of the prevailing northwest dip of the surface strata. As mentioned above under the description of Buffalo District, both these folds are much more pronounced so far as they affect the lay of the Big Injun, as a glance at the elevation column for the latter sand in the Clay County Table of Well Records, given on pages 346-349, will readily show. In 1915, only 6 wells had been completed within the borders of Pleasant District, all of which were abandoned as dry holes. These were all located along the northwest border, mostly on the waters of Sycamore Creek, the detailed logs of which follow herewith:

Thompson Land & Coal Co. No. 2 Well Record (No. 128 on Map II).

Pleasant District, Clay County, on the south bank of Elk River, ¼ mile southwest of Big Sycamore; drilled by South Penn Oil Company; authority, H. B. Davenport; completed in 1914; elevation, 765' B.

	Thickness. Feet.	Total. Feet.
Conductor	8	8
Sand	30	38
Coal, Winifrede	2	40
Slate	10	50
Sand	40	90
Coal, Chilton	5	95
Sand	45	140
Slate	15	155
Lime	23	178
Slate	6	184
Lime	36	220
Slate	4	224
Lime	96	320
Coal, Cedar Grove ?	4	324
Lime	56	380
Coal, No. 2 Gas?	3	383
Lime	57	440
Slate	18	458
Lime	12	470
Slate	25	495
Sand	35	530
Lime	95	625
Sand	75	700
Sand, Salt, (big water at 730')	350	1050
Slate, break	5	1055
Sand	10	1065
Slate, cave	50	1115
Red rock	5	1120
Lime	24	1144
Sand	85	1229
Lime	5	1234
Red rock	10	1244
Lime	46	1290
Sand, Maxton (gas and show oil at 1310'-1330')	65	1355
Slate	1	1356
Little Lime	40	1396
Slate	34	1430
Pencil Cave	6	1436
Big Lime	99	1535
Sand, Big Injun (show of oil at 1590')	60	1595
Lime, black	14	1609
Red rock	12	1621
Slate and shell	9	1630
Slate, black	40	1670
Lime, sandy	95	1765
Slate and shell	95	1860
Lime, sandy	65	1925
Slate	48	1973

	Thickness. Feet.	Total. Feet.
Hard shell	6	1979
Slate	6	1985
Sand, Berea, (show of gas at 1985')	30	2015
Slate and shell	40	2055
Lime, sandy, (show of gas at 2055')	15	2070
Slate and shell	60	2130
Lime, black	20	2150
Lime, sandy	25	2175
Slate	15	2190
Shell	25	2215
Slate	20	2235
Lime, sandy	20	2255
Slate and shell	35	2290
Lime, sandy	12	2302
Slate and shell	113	2415

The above boring starts on the lower edge of the bench for the Coalburg Coal, probably 10 to 15 feet below the latter bed. Shows of oil and gas were encountered in several different zones, but not in sufficient quantities to prevent its abandonment as a non-paying well. A good thickness—30 feet—of Berea Sand is noted, this zone having been conspicuous by its absence from most of the logs published on preceding pages for Clay County and southern Braxton. The well penetrated below the horizon of the Fifth without finding any sands in the Catskill Series.

Thompson Land & Coal Co. No. 1 Well Record (No. 129 on Map II).

Pleasant District, on west bank of Sycamore Creek, 1.7 miles southeast of Big Sycamore; authority, South Penn Oil Company; completed in 1913; elevation, 725' B.

	Thickness. Feet.	Total. Feet.
Conductor	16	16
Unrecorded	9	25
Gravel bed	8	33
Sand	47	80
Coal, Williamson?	6	86
Slate	14	100
Sand	40	140
Coal, Cedar Grove?	4	144
Slate	56	200
Sand	70	270
Slate	55	325
Sand	75	400
Lime	30	430
Slate	65	495

	Thickness. Feet.	Total. Feet.
Sand	88	583
Slate	12	595
Sand (show of oil at 630'; hole full of water at 695')	205	800
Slate	10	810
Sand, Salt (break of slate, 920'-926')	310	1120
Slate	95	1215
Sand	20	1235
Red rock	53	1288
Sand	21	1309
Slate	11	1320
Lime	25	1345
Red rock	15	1360
Lime	30	1390
Cave	11	1401
Lime	19	1420
Slate	10	1430
Little Lime	35	1465
Sand	18	1483
Pencil Cave	9	1492
Big Lime	133	1625
Red rock	5	1630
Sand, Big Injun (show of gas and oil at 1655')	40	1670
Red rock	10	1680
Sand	5	1685
Red rock	15	1700
Sand, Squaw	20	1720
Slate and shell	42	1762
Sand, Weir	25	1787
Slate and shell	115	1902
Lime, hard	73	1975
Slate and shell	271	2246
Lime, sandy	26	2272
Slate and shell	52	2324
Sand, Gordon?	12	2336
Lime and slate	29	2365
Shell, hard	4	2369
Slate	24	2393
Sand, blue, Fifth?	32	2425
Slate and shell	17	2442

Sand, loose, 1650'-1663'; sand, black, 1663'-1670'; 8¼" casing, 563'; 6½" casing, 1175'; 5" casing, 1492'.

The above well starts 5 to 10 feet above the horizon of the Winifrede Coal and about 410 feet below the Upper Kittanning bed as determined by the writer. Its record reveals the lenticular nature of the sands below the Big Injun in this portion of the State, since the Squaw, Weir, Gordon, and Fifth appear to be present and the Berea, absent, the converse being true in the record of well **No. 128 on Map II** previously given. It was abandoned as a dry hole, since only showings of oil and gas were encountered. The following is the record of a well drilled on the same tract by the same company which starts about 400 feet below the Upper Kittanning Coal, only shows of oil and gas being found and the well abandoned as a dry hole:

Thompson Land & Coal Co. No. 3 Well Record (No. 130 on Map II).

Pleasant District, Clay County, on branch of Sycamore Creek, 1.8 miles N. 65° E. of Warfield; drilled by South Penn Oil Co.; authority, H. B. Davenport; completed, August 3, 1914; elevation, 775' B.

	Thickness. Feet.	Total. Feet.
Conductor	13	13
Sand	30	43
Coal, Chilton	4	47
Sand	35	82
Coal, Hernshaw	5	87
Lime and slate	78	165
Sand and lime	122	287
Coal, No. 2 Gas?, (and gas)	6	293
Lime and slate	99	392
Coal, Eagle? (and more gas)	7	399
Sand and slate	141	540
Sand, Rosedale Gas, Nuttall?	120	660
Slate	10	670
Sand, Rosedale Salt (show of oil at 674')	477	1147
Slate (8" casing, 1223')	76	1223
Sand to base of **Pottsville Series**	87	1310
Lime	25	1335
Red rock	15	1350
Slate	45	1395
Red rock	25	1420
Lime	25	1445
Slate	25	1470
Little Lime	45	1515
Sand	21	1536
Pencil Cave	13	1549
Big Lime (gas at 1645')	148	1697
Sand, Big Injun (show of oil at 1717-1725')	35	1732
Red rock	6	1738
Slate and shell	119	1857
Slate	133	1990

Elk River Lumber Co. No. 2 Well Record (No. 131 on Map II).

Pleasant District, Clay County, in hollow on west side of Sycamore Creek, 0.5 mile east of Warfield; authority, Crude Oil Company; completed, September 15, 1915; elevation, 1110' B.

	Top. Feet.	Bottom. Feet.
Coal, Coalburg	248	
Coal, Williamson?	425	
Sand, Rosedale Gas	780	835
Sand, Salt	848	870
Sand, Rosedale Salt	950	1487
Sand, Maxton	1568	1585
Red rock	1585	1630
Sand, Maxton	1630	1700
Little Lime	1770	1800
Pencil Cave	1800	1830
Big Lime	1830	1975
Sand, Big Injun	1975	2025
Red rock	2025	2050
Sand, Squaw	2060	2073
Total depth		2103

The above well starts about 85 feet below the horizon of the Upper Kittanning Coal and was plugged and abandoned as a dry hole, not a show of oil or gas being recorded in its log.

Elk River Lumber Co. No. 1 Well Record (No. 132 on Map II).

Pleasant District, Clay County, on head of Lick Branch of Adonijah, 1.3 miles southwest of Warfield; authority, Crude Oil Company; completed, April 4, 1914; elevation, 1180' B.

		Top. Feet.	Bottom. Feet.
Sand		505	644
Sand, Rosedale Gas (a little gas at 860')		850	895
Sand, Rosedale Gas (gas at 945')		910	945
Sand, Salt (hole full of water at 1320')		945	1675
Slate		1675	1700
Red rock and lime		1700	1800
Cave		1800	1810
Little Lime		1845	1880
Pencil Cave		1880	1908
Lime, black 22'			
Lime, white 50			
Sand 20	Big Lime (143')	1908	2051
Lime 43			
Sand 8			
Slate		2051	2053

	Top. Feet.	Bottom. Feet.
Sand, Big Injun (hard and white, 2053-2079'; soft and black, 2079-2102')	2053	2102
Red rock	2102	2125
Shells, sandy	2125	2280
Total depth		2311

The above well starts about 50 feet below the horizon of the Upper Kittanning Coal and was plugged and abandoned as a dry hole, its log not recording a show of either oil or gas, except in the **Rosedale Gas Sand.** It is very probable that many shale or coal divisions occur in the great sandstone mass at 945 feet, which the drillers failed to record.

The detailed log of the **Elk River Lumber Company No. 1 well—No. 133 on Map II**—drilled by the Eldorado Oil and Gas Company in the spring of 1910, is published in Chapter IV in connection with the Lick Branch of Adonijah Section, pages 149-153. It was plugged and abandoned as a dry hole, since only showings of oil and gas were encountered.

The **Lackawanna Coal and Lumber Company No. 2 well—No. 134 on Map II**—located in the southeast portion of Pleasant District, Clay County, on the head of Road Fork, 1 mile northwest of Greendale, was begun by the Lackawanna Coal and Lumber Company during 1914 and drilled to a depth of about 150 feet, where it was shut down. When visited by the writer in October, 1915, the derrick was still standing, although all the drilling tools had been removed. It starts only 10 feet below an opening in the Upper Kittanning Coal bed, so that it is doubtful if the boring penetrated to the top of the Pottsville Series, and of course could not be considered a test for the region.

The 3 following records are from wells completed just across the line from Pleasant District (Clay) in the edge of Nicholas County:

Lackawanna Coal & Lumber Co. No. 1 Well Record (No. 135 on Map II).

Nicholas County, on Rockcamp Fork, 1 mile northeast of Greendale, and 0.3 mile southeast of Clay-Nicholas Line; authority, Lackawanna Coal & Lumber Co.; completed, August 3, 1914; elevation, 1070′ B.

	Thickness. Feet.	Total. Feet.
Quicksand, surface	10	10
Gray sand	20	30
Black slate	50	80
White sand	7	87
Coal, Williamson?	3	90
Black slate	10	100
Gritty lime	36	136
Coal, Cedar Grove	2	138
Black slate	52	190
Sand	10	200
Lime	30	230
Slate	40	270
Sand	23	293
Slate and shells	39	332
Lime	38	370
Slate	10	380
Sand	52	432
Slate	8	440
Shells	34	474
Coal, Little Eagle	6	480
Lime	36	516
Black slate, Eagle?	20	536
White sand, Lower War Eagle and Upper Gilbert	54	590
Lime	10	600
Slate and shells	12	612
Lime and sand	23	635
Slate and shells	65	700
Lime	160	860
Sand, Rosedale Gas, (Nuttall) "Dotson," (5 bailers of water per hour at 980′)	130	990
Slate	24	1014
Lime	18	1032
Slate	30	1062
Sand, Guyandot and Lower Guyandot	208	1270
Coal, Sewell?	2	1272
Lime	36	1308
Slate	42	1350
Lime	31	1381
Slate cave	74	1455
Lime	10	1465
Slate and shells	35	1500
Lime	20	1520
Sand	30	1550
Red rock	80	1630
Lime	38	1668
Red rock	17	1685
White slate	5	1690

	Thickness. Feet.	Total. Feet.
Red lime	65	1755
White slate	35	1790
Black lime, Maxton	70	1860
Black slate, Pencil	27	1887
Big Lime (gas, 1937′ and 2050′)	210	2097
Red rock	10	2107
Slate and shale	69	2176
White slate	11	2187
Slate and shells	113	2300
Blue sand	4	2304
Slate and shells	186	2490
Coffee slate	8	2498
Slate and shells	317	2815
Light slate	25	2840
Lime	20	2860
Slate	10	2870
Lime	40	2910
Slate	10	2920
Lime	4	2924
Slate	31	2955
Lime	10	2965
Slate and shells	45	3010
Slate	130	3140
Shells	55	3195
Lime	15	3210
Slate and shells	60	3270
Lime	40	3310
Slate and lime	110	3420
Brown shale	45	3465
Slate and shells	115	3580
Lime	35	3615
Slate and shells	100	3715
Lime	20	3735
Soft slate	10	3745
Hard lime	15	3760
Slate and shells	35	3795
Lime, hard	25	3820
Slate, soft	10	3830
Lime, dark	40	3870
Slate	10	3880
Slate and shells to bottom	99½	3979½

Conductor, 20′; 10″ casing, 143′; 8″ casing, 1292′; 6⅝″ casing, 1897′

The above well starts about 15 feet below an opening in the Winifrede Coal and about 465 feet below the Upper Kittanning bed. The well was shut in when visited by the writer during October, 1915, being a light gasser from the Big Lime. The log gives its volume at 50,000 cubic feet daily.

Hill-Long No. 1 Well Record (No. 137 on Map II).

Nicholas County, on west bank of Copen Fork, 0.3 mile south of Carterboro and Clay-Nicholas Line; authority, Coalbell Coal Co.; completed, June, 1915; elevation, 840′ B.

	Thickness. Feet.	Total. Feet.
Loose dirt	15	15
Rock	30	45
Slate	30	75
Sand	35	110
Slate, hard	120	230
Sand	10	240
Slate	10	250
Lime	45	295
Conglomerate 15′ Slate 5 Sand 85 — Nuttall? Rosedale Gas	105	400
Slate	5	405
Coal, Hughes Ferry?	3	408
Sand, Nuttall?, Rosedale Gas	92	500
Lime, sandy	42	542
Coal show, Sewell?	2	544
Lime, sandy	46	590
Slate	45	635
Sand, Rosedale Salt, (Raleigh), hard	190	825
Slate	25	850
Lime, sandy, hard	65	915
Sand and lime, extra hard	225	1140
Slate cave	12	1152
Sand and shells, hard	43	1195
Red rock	25	1220
Slate and shells	90	1310
Red rock	45	1355
Slate and shells	35	1390
Red rock	30	1420
Lime	35	1455
Lime, sandy, last 15′, Maxton Sand	45	1500
Slate and lime shells	30	1530
Lime	30	1560
Slate	20	1580
Slate cave	15	1595
Big Lime (gas in bottom)	145	1740
Sand, Big Injun	97	1837
Slate and shells	339	2176
Sand, Berea, broken	35	2211
Slate and shells to bottom	64	2275

The above well starts about 335 feet below the Coalburg Coal and 700 feet below the horizon of the Upper Kittanning bed, the elevation of the well mouth being obtained by Gawthrop. It was abandoned as a dry hole, only a show of gas being found in the Big Lime.

The following is the record of a light gasser from the Keener and Big Injun—250,000 cubic feet daily from each sand—which starts about 640 feet below the Kanawha Black Flint and 925 feet below the Upper Kittanning Coal. Only 6 feet of Berea Sand is recorded as against 35 feet of broken sand at this horizon in the Hill-Long No. 1 well last described:

H. O. Havener No. 1 Well Record (No. 138 on Map II).

Nicholas County, on Lick Branch, 0.4 mile northeast of Dixie; authority, E. A. Mead; completed, January 23, 1913; elevation, 785' B.

	Thickness. Feet.	Total. Feet.
Soil	15	15
Sand, (water at 65')	65	80
Slate	10	90
Sand	20	110
Slate	50	160
Sand and lime shells	30	190
Slate	110	300
Sand, very hard, white, Rosedale Gas?	35	335
Slate and lime shells	120	455
Slate	33	488
Lime, very hard, gray	67	555
Lime, rotten, black	12	567
Lime, hard, gray	48	615
Sand, hard, gray	30	645
Slate and lime shells	35	680
Sand, hard, gray, (3 bailers of water)	20	700
Slate	5	705
Sand, white	45	750
Shale, black	5	755
Sand, white, (a little water)	70	825
Sand, gray	55	880
Slate and lime shells	25	905
Lime, hard, gray	25	930
Sand, white	120	1050
Slate and lime shells	65	1115
Sand	5	1120
Lime, black	30	1150
Sand, gray	40	1190
Slate and lime shells	10	1200
Red rock	25	1225
Slate and shells	20	1245
Lime, gray	50	1295
Red rock	47	1342
Slate and lime shells	43	1385
Red rock	35	1420
Slate	10	1430
Sand, Maxton, top hard, balance good	30	1460
Lime	131	1591
Pencil Cave	6	1597
Big Lime, regular	151	1748

	Thickness. Feet.	Total. Feet
Red rock, hard	8	1756
Sand, Keener, good, (show of gas)	2	1758
Lime shells	12	1770
Sand, white, hard 16'		
Sand, red, coarse, (trace of oil at 1807'; show of gas) 25 } Big Injun	41	1811
Slate and lime shells	389	2200
Shells, hard	13	2213
Shale, brown	6	2219
Sand, Berea, white, hard	6	2225
Slate to bottom	10	2235

10" casing, 20'; 8¼" casing, 480'; 6⅝" casing, 1620'.

PROSPECTIVE OIL AND GAS AREAS, PLEASANT DISTRICT, CLAY COUNTY.

A study of the foregoing well records from Pleasant District shows the results of all the tests thus far completed within its borders to be of a negative nature as far as oil and gas in paying quantities are concerned. As in Buffalo and Henry Districts, it is difficult to determine the lay of the Big Injun and lower sands, since these do not at all conform to that of the surface strata as a glance at Map II and the elevation column for the Big Injun in the Clay County Table of Well Records will readily show, due, as has already been explained, to the rapid expansion of the Pottsville and Mauch Chunk Series. Keeping in mind the remarks given in connection with the possible oil and gas areas described in Henry District, there are at least three regions within Pleasant that warrant the drilling of further test wells. (1) That area lying immediately along the crest of the Hansford Anticline southward from Elk River to Sycamore Creek appears favorable for gas in the Big Injun and higher sands, based solely on surface structure; (2) that, along the axis of the Handley Syncline southwestward from Sycamore Creek to the Kanawha County Line, for the same reason is favored for oil in the same sands; and (3) that, on the structural terrace outlined by the wide divergence of the 1250- and the 1275-foot contours of the Upper Kittanning Coal (See Map II) eastward from the head of Lick Branch of Middle Creek to the Pleasant-Henry District Line, for oil or gas in the same zones.

DETAILED WELL RECORDS IN UNION DISTRICT (CLAY COUNTY).

Union District, occupying the western corner of Clay County, is traversed in a northeast-southwest direction by 3 structural folds; viz, the Chestnut Ridge and Hansford Anticlines and the Grassland Syncline, features that have played no small part in the segregation within its borders of the only oil pool yet developed in the county, as also the only commercial gas pool. For the description of the opening of each of these pools, the reader is referred to the **Early History** of the oil and gas development in Clay County, page 344. The chief oil-bearing zone is the Big Injun Sand, although the Salt has produced some oil in at least two wells. As shown in detail on Map II, the main oil field lies along both sides of the axis of the Grassland Syncline between Porter Creek and the north hillside of Elk River on the waters of Birch and Upper Birch Runs and Porter and Camp Creeks, with three small wells on the north bank of Elk. On November 15, 1915, a total of 62 producing oil wells had been completed, giving the field a production of 300 to 400 barrels daily, according to H. B. Davenport of Clay, who has been prominent in its development. The gas field, drawing its supply from both the Keener and Big Injun Sands, lies at a higher structural level to the west, southwest, and south of the oil pool in question, partly along the crest of the Chestnut Ridge Anticline. On the date last mentioned, a total of 45 to 50 gassers had been completed within the borders of Union District.

The producing oil wells will now be described roughly from north to south in their numerical order on Map II. From the above data, it is quite evident that the wells are very light, the initial daily production of the 62 completed wells probably not averaging over 5 barrels. On the north side of Elk in Union District, only 6 wells have been drilled, one of which resulted in a light gasser in the Big Injun; three, light oil producers from the same sand; and two, in dry holes, although one did not penetrate down to the Big Injun. The following is the record of the gas well in question, the well-mouth being about 250 feet below the Upper Kittanning Coal:

B. M. Samples No. 1 Well Record (No. 139 on Map II).

Union District, on north bank of Elk River, 0.4 mile south of Procious; well by Samples Oil Company; authority, H. B. Davenport; completed, February, 1915; elevation, 658′ L.

			Thickness. Feet.	Total. Feet.
Soil, sand, etc			565	565
Sand, Rosedale Gas, and unrecorded			159	724
Sand	283′	Rosedale Salt	381	1105
Slate	3			
Sand	95			
Red rock and top member of Mauch Chunk Series			15	1120
Lime			15	1135
Sand, hard			55	1190
Slate			7	1197
Sand, Maxton			43	1240
Little Lime			39	1279
Pencil Cave			25	1304
Big Lime			85	1389
Sand, Keener (no gas)			26	1415
Sand, Big Injun			67	1482
Slate and shells			5	1487
Red rock			3	1490
Slate and shells to bottom			35	1525

"Sand, hard, white, pebbly, little gas, 1437-1440′; sand, hard, white, 1440-1443′; sand, white, pebbly, more gas and oil smell, 1443-1454′; sand, micaceous, gray, pebbly, soft, oil show and some gas, 1454-1463′; sand, coarse, blue, pebbly, gas doubled, 1463-1471′; sand, soft, blue, 1471-1482′; 500,000 cu. ft. gas daily in Big Injun Sand; 10″ casing, ——; 8″ casing, 196′; 6⅝″ casing, 1304½′."

The detailed log of the **Harvey Samples No. 2 well—No. 140 on Map II**—located on the north bank of Elk River, 1 mile south of Procious, is published in Chapter IV in connection with the Marne—0.7 Mile West Section, pages 157-8, along with other items of interest. As shown in the table of wells for Clay County, the top of the Big Injun Sand is 32 feet lower in elevation than in the well last described, although both appear to be on the same structural level of the surface strata. This discordance in the lay of the sand in question and the Upper Kittanning Coal becomes more and more striking in passing southward to the **Blue Creek Coal & Land Co. No. 4 well—No. 245 on Map II**—in the southern point of Union District where the top of the former has dipped to an elevation almost 200 feet lower than in the Samples well (140), and the latter seam risen 340 to 350 feet. The greatly increased interval between the two members is mostly due to the enormous expansion of the Mauch Chunk Series here, although that of the Pottsville beds has contributed slightly to it. It is quite evident that when a sufficient number of wells have been completed in southern and western Clay County to obtain elevations on the top of the Big Injun—the main oil and gas sand—that the effective development of the region would be greatly enhanced by a contour map on the top of the latter zone. The data are already available for such a map of the northern two-thirds of Union District.

The **Harvey Samples No. 1 well—No. 141 on Map II—** located on the north side of Elk River, in ravine, 250 to 400 feet southeast of the well last described and drilled about 10 years ago primarily for salt water by parties from Parkersburg, West Virginia, and Philadelphia, Pennsylvania, penetrated to a depth of only 600 to 700 feet, according to natives, and lacked 700 to 800 feet of reaching the top of the Big Injun Sand, since it starts about 230 feet below the Upper Kittanning Coal, as determined by the writer. It probably stopped just short of the salt water pay recorded in the log of well No. 140 on Map II, described above, since it was abandoned on completion.

The detailed log of the **Harvey Samples No. 1 well—No. 142 on Map II**—located on the north bank of Elk River, 0.1 mile south of well No. 140 on Map II, described above, and completed by the South Penn Oil Company in 1894, is published on pages 474-5 of Volume I(a) of the State Survey Reports, and its summarized record in the table of wells for Clay County. This well had a 2-barrel daily showing of oil in the Big Injun Sand.

The two following records are from the remaining wells on the north bank of Elk River:

Harvey Samples No. 1 Well Record (No. 143 on Map II).

Union District, on north bank of Elk River, 0.9 mile northwest of Rouzer; well by Samples Oil Company; authority, H. B. Davenport; completed, May 13, 1914; elevation, 665' B.

			Thickness. Feet.	Total. Feet.
Unrecorded			750	750
Sand, Rosedale Salt			405	1155
Red rock and unrecorded			105	1260
Sand, Maxton			30	1290
Little Lime			42	1332
Pencil Cave			13	1345
Big Lime			95	1440
Sand, Keener			26	1466
Sand, white	27'	Big Injun	63	1529
Sand, white, soft, (gas pay)	7			
Sand, gray, (oil pay)	8			
Sand, blue, fine-grained	13			
Sand, blue, coarse-grained	8			

"Initial oil production after shot 2 barrels daily; production now, 1½ barrels daily. 6⅝" casing, 1348'."

The above well starts about 240 feet below the horizon of the Upper Kittanning Coal. The driller has evidently failed to record slate and shale divisions in the great sandstone mass at 750 feet in depth.

Goshorn and Brown No. 532 Well Record (No. 144 on Map II).

Union District, Clay County, on north bank of Elk River, 0.5 mile north of mouth of Laurel Creek; authority, Unitel Fuel Gas Co.; completed, September 23, 1913; elevation, 665' B.

	Thickness. Feet.	Total. Feet.
Sand and gravel	42	42
Sand, white	12	54
Slate, blue	11	65
Coal, Winifrede?	4	69
Slate, blue	21	90
Sand, white	80	170
Broken up, (show of gas at 250')	185	355
Coal, No. 2 Gas?	5	360
Broken up (show of oil and gas at 405')	230	590
Sand, Rosedale Gas (show of oil and gas at 636')	85	675
Broken up	20	695
Coal, Sewell?	3	698
Lime	23	721
Sand, Rosedale Salt	432	1153
Red rock	37	1190
Slate	83	1273
Sand, Maxton (show of oil at 1279')	22	1295

	Thickness. Feet.	Total. Feet.
Little Lime	20	1315
Pencil Cave	4	1319
Big Lime (show of gas at 1428′ and 1431′)	112	1431
Sand, Rouzer	12	1443
Lime	31	1474
Sand, Keener	41	1515
Sand, Big Injun	13	1528
Broken up	122	1650
Sand, Weir	12	1662
Broken up	58	1720
Slate	940	2660
Sand, broken up	15	2675
Slate to bottom	15	2690

10″ casing, 42′ 2″; 8¼″ casing, 1191′; 6⅝″ casing, 1406½′.

The above well starts about 245 feet below the horizon of the Upper Kittanning Coal, as determined by the writer. It was abandoned as a dry hole, although showings of oil or gas were encountered in several different zones. A new sand makes its appearance in the record, in the basal portion of the Big Lime, 31 feet above the bottom of the latter member. The driller has designated it the **Rouzer Sand** from the Coal and Coke Railway station, slightly less than one-half mile southward.

The **F. & M. Craig No. 1 well—No. 145 on Map II—** located on the west bank of Camp Creek, 1.7 miles south of Procious, drilled early in 1914 by the Eastern Carbon Black Company, and examined on the ground by Gawthrop, had been abandoned as a dry hole when visited by the latter in 1915. The Survey was unable to obtain its log.

Brown and Goshorn No. 2 Well Record (No. 148 on Map II).

Union District, on Camp Creek, 1 mile due west of Rouzer; well by Goshorn Oil and Gas Company; authority, H. B. Davenport; completed, December 21, 1914; elevation, 910′ B.

	Thickness. Feet.	Total. Feet.
Soil	19	19
Slate	17	36
Lime	11	47
Slate and lime	103	150
Coal, "No. 5 Block"	1	151
Slate and lime	81	232
Coal, Stockton	2	234
Sand	36	270
Slate	30	300

	Thickness. Feet.	Total. Feet.
Coal, Coalburg	2	302
Slate and lime	38	340
Sand	90	430
Slate and lime	120	550
Sand	60	610
Slate and lime	214	824
Sand, Rosedale Gas, (black oil show)	88	912
Lime and slate	98	1010
Sand, Salt (slate break—cave—1336-43')	372	1382
Slate, white	8	1390
Red rock and lime	117	1507
Sand, Maxton (oil show)	49	1556
Slate	5	1561
Little Lime	30	1591
Slate	17	1608
Pencil Cave	7	1615
Big Lime	90	1705
Sand, Keener (gas)	32	1737
Sand, Big Injun, to bottom	48	1785

250,000 cu. ft. gas, 1725-1737'; oil show, 1761-4'; oil show, better, 1770-80'; shot with 40 qts. 1760-76'; hole had filled up 2 feet and made 6½ feet anchor. Initial production, 6 barrels daily; now (October 15, 1915) 6 barrels daily; 10" casing, 42' 9"; 8¼" casing, 318'; 6⅝" casing, 1365'; 5$\frac{3}{16}$" casing, 1621'.

The above well, examined by Gawthrop, starts almost flush with the Upper Kittanning Coal. Here, a nice flow of gas was encountered in the Keener, in addition to the oil in the Big Injun. A show of black oil was found in the Gas Sand of Rosedale. It is very probable that the latter zone may correlate with the Nuttall Sandstone at the top of the New River Series.

Brown and Goshorn No. 1 Well Record (No. 149 on Map II).

Union District, on east bank Camp Creek, 0.9 mile due west of Rouzer; well by Davenport Oil and Gas Co.; authority, H. B. Davenport; completed, August 12, 1914; elevation, 910' B.

	Thickness. Feet.	Total Feet.
Soil and gravel	36	36
Lime, slate, etc	114	150
Coal, "No. 5 Block"	1	151
Slate and lime	81	232
Coal, Stockton	2	234
Sand	36	270
Slate	30	300
Coal, Coalburg	2	302
Slate, lime, sand, and shells	248	550

	Thickness. Feet.	Total. Feet.
Sand	60	610
Slate and lime	202	812
Sand, Rosedale Gas (oil show, 881')	100	912
Lime	48	960
Slate and lime	36	996
Sand, Rosedale Salt (big water, 1075')	328	1324
Slate (cave)	4	1328
Sand	24	1352
Slate	3	1355
Lime (cave)	21	1376
Lime, sandy	16	1392
Slate, white	8	1400
Red rock	96	1496
Lime	15	1511
Sand, very hard, Maxton	52	1563
Slate	2	1565
Little Lime	37	1602
Slate	2	1604
Shells	4	1608
Pencil Cave	7	1615
Big Lime (gas, 1675')	95	1710
Sand, Keener (gas, 1730-1743')	33	1743
Sand, Big Injun, to bottom	45	1788

"Sand, hard, 1743-1767'; sand, medium-hard, oil smell, 1767-1775'; sand, soft, pebbly, good oil show, 1775-1780'; sand, pale-blue, 1780-1788'. This well made about 750,000 cu. ft. of gas in Keener Sand. Oil production, 2 barrels daily from Big Injun."

The above well, examined by Gawthrop, starts almost flush with the Upper Kittanning Coal bed, and, as with the well last described, it gives a close measurement of the interval separating the coal last mentioned from the No. 5 Block seam. In addition to its oil production from the Big Injun, it is a fair gasser from the Keener Sand.

Frank Cox No. 14 Well Record (No. 150 on Map II).

Union District, on branch of Camp Creek, 1.1 miles northeast of Bomont; well by Davenport Oil and Gas Co.; authority, H. B. Davenport; completed, September 7, 1915; elevation, 1030' B.

	Thickness. Feet.	Total. Feet.
Soil	17	17
Slate	17	34
Lime	13	47
Sand, Lower Freeport, Upper East Lynn, and East Lynn	213	260
Coal, "No. 5 Block"	1	261
Sand, Homewood	81	342
Coal, Stockton	3	345
Sand, Upper Coalburg	55	400

	Thickness. Feet.	Total. Feet.
Coal, Coalburg	2	402
Slate	14	416
Sand	2	418
Slate and shells	57	475
Sand	71	546
Slate and lime	129	675
Sand	75	750
Slate and shells	210	960
Sand, Rosedale Gas (oil show, 1050′)	120	1080
Sand, Rosedale Salt	398	1478
Slate (cave)	4	1482
Sand	40	1522
Red rock and lime	148	1670
Sand, Maxton	17	1687
Slate	9	1696
Little Lime	41	1737
Pencil Cave	5	1742
Big Lime	97	1839
Sand, Keener	27	1866
Slate, break	1	1867
Sand, Big Injun, to bottom	51	1918

"Sand, hard, 1839-1851′; sand, medium hard, 1851-1855′; gas pay, 1855-1866′; slate break, 1866-1867′; sand, soft, large pebbles, coarse-grained, 1867-1873′; sand, white, hard, 1873-1893′; sand, pebbly, oil show, 1893-1895′; first oil pay, 1895-1903′—10 barrels; sand, hard, 1903-1905′; second oil pay, (15 barrels), 1905-1911′, sand, very coarse; sand, blue, 1911-1918′.

"Shot September 10, 1915, with 40 quarts—14′ shell placed at 1894-1908′. The 'jack' telescoped first shell and glycerine went down to bottom and shot up blue sand instead of top pay.

"10″ casing, 27′; 8¼″ casing, 560′; 6⅝″ casing, 1482′; 5 3/16″ casing, 1750′."

This well made 25 barrels daily at first and still making 20 barrels on October 8, 1915. Its elevation was determined by Gawthrop, the well-mouth being about 110 feet above the horizon of the Upper Kittanning Coal bed. A light pay of gas was encountered in the basal portion of the Keener Sand, in addition to the oil pays in the Big Injun.

Frank Cox No. 11 Well Record (No. 151 on Map II).

Union District, on head of Camp Creek, 1.1 miles northeast of Bomont; well by Davenport Oil and Gas Company; authority, H. B. Davenport; completed, August 10, 1914; elevation, 970′ B.

	Top. Feet.	Bottom. Feet.
Big Lime	1677	1780
Sand, Keener (gas, 1795-1802′)	1780	1802
Slate	1802	1808
Sand, Big Injun (oil pay, 1838-1851′)	1808	1857

"Initial production, 11 barrels daily natural. Now (October 15, 1915), producing 13 barrels daily. Shot, October 2, 1914, with 40 quarts glycerine. Top of shot at 1838'. Flowed through casing for year then put to pumping. 10" casing, 17'; 8¼" casing, 400'; 6⅝" casing, 1680'; pulled the 8¼" casing."

The above well, examined by Gawthrop, starts about 60 feet above the horizon of the Upper Kittanning Coal.

Frank Cox No. 13 Well Record (No. 151A on Map II).

Union District, on head of Camp Creek, 1 mile northeast of Bomont; well by Davenport Oil and Gas Co.; authority, H. B. Davenport; completed, July 9, 1915; elevation, 1125' B.

	Thickness. Feet.	Total. Feet.
Red clay	17	17
Sand, etc	428	445
Coal, Stockton	1	446
Sand, Upper Coalburg	54	500
Coal, Coalburg	3	503
Lime	12	515
Coal, (cannel) Winifrede	5	520
Lime	7	527
Sand	65	592
Lime	9	601
Slate and shells	459	1060
Sand, Rosedale Gas (oil show, 1100-1132')	90	1150
Slate and shells	70	1220
Sand, Rosedale Salt (slate, 1348-1354'; big water 1435')	390	1610
Lime	28	1638
Red rock and shells	100	1738
Sand, Maxton	22	1760
Slate, black (cave)	18	1778
Little Lime	35	1813
Pencil Cave	12	1825
Big Lime	95	1920
Sand, hard, white, Keener	33	1953
Slate break	3	1956
Sand, Big Injun	42	1998

"Details of **Keener Sand**: Sand, hard, white, 1920-1940'; sand, soft, 1940-1953'; gas, 1950-1953'. **Big Injun Sand**: Sand, soft, large pebbles, gas, 1956-1962'; sand, hard, 1962-1966'; sand, medium-hard, 1966-1980'; shell, hard, 1980-1982'; first oil pay (good oil show) steel tape, 1982-1983'; sand, hard, 1983-1985'; second oil pay, sand, coarse, pebbly and best pay, 1985-1993'; sand, blue, to bottom, 1993-1998'.

"Put on casing-head and nipple which added 1⅛ feet to the steel-line measurement, making total depth from top of casing-head as 1999⅛ feet.

"Well made 50 barrels the first 24 hours and 40 barrels the second 24 hours, and is still making 33 barrels daily, natural, having never been shot, and is **best well in field** on November 1, 1915."

10" casing, 18'; 8¼" casing, 592'; 6⅝" casing, 1825'.

The above well, the elevation of which was determined by Gawthrop, starts about 210 feet above the Upper Kittanning Coal. Previous to the completion of the **C. P. Samples No. 7 well—No. 166 on Map II**—on November 11, 1915, it was the best oil producer in Clay County. The description of the latter well is given on a subsequent page.

Frank Cox No. 2 Well Record (No. 152 on Map II).

Union District, on head of Camp Creek, 1.2 miles northeast of Bomont; well by Davenport Oil and Gas Company; authority, H. B. Davenport; completed, October, 1912; elevation, 1115' B.

	Thickness. Feet.	Total. Feet.
Soil	12	12
Sand, yellow	68	80
Sand, white	120	200
Coal, "Queen Shoals," Upper Kittanning	5	205
Lime	20	225
Sand (4 bailers water, 240') Upper and Lower East Lynn	155	380
Coal, "No. 5 Block"	5	385
Lime	65	450
Sand, Upper Coalburg	45	495
Coal, Coalburg	5	500
Lime	25	525
Sand	110	635
Lime	15	650
Slate and lime	90	740
Sand	85	825
Lime, with slate	65	890
Slate and shells	145	1035
Sand, **Rosedale Gas** (oil show, 1050-1100')	95	1130
Slate	70	1200
Sand, **Rosedale Salt** (water, 1115', 1300'; hole full of water, 1470')	330	1530
Slate (cave)	20	1550
Red rock (not found in others)	3	1553
Sand	47	1600
Slate and shells	10	1610
Red rock, with brown streaks	50	1660
Slate, brown	30	1690
Slate, white, and shells	22	1712
Sand, Maxton	52	1764
Slate	3	1767
Little Lime	31	1798
Slate and shells	25	1823
Big Lime	97	1920
Sand, Keener	35	1955
Slate	5	1960
Sand, **Big Injun**	49	2009
Red rock to bottom	2	2011

"Details of Big Injun Sand follow: Gas pay, 1975-1978'; oil pay, 1978-1990'; sand, blue, 1990-2009'. Initial production, 3 to 4 barrels daily; now (October 15, 1915) 2 barrels daily. 10" casing, 35'; 8" casing, 635'; 6⅝" casing, 1553'."

The above well, the elevation of which was determined by Gawthrop, starts 200 feet above the horizon of the Upper Kittanning Coal. The interval between the latter bed and the **No. 5 Block** seam has increased to 175 feet as against 150 to 160 feet at wells **Nos. 148 and 149 on Map II,** described on preceding pages. The interval between the Upper Kittanning and Coalburg Coals is practically the same as found by measurement on outcrop on the south hillside of Elk River at Dorfee.

Betty G. Bell No. 1 Well Record (No. 153 on Map II).

Union District, on head of branch of Birch Run, 0.9 mile southwest of Rouzer; well by Davenport Oil and Gas Company; authority, H. B. Davenport; completed, February 11, 1912; elevation, 1110'B.

	Thickness. Feet.	Total. Feet.
Conductor	**12**	**•12**
Lime	**118**	**130**
Sand, Lower Freeport	**50**	**180**
Coal, Upper Kittanning	**4**	**184**
Lime	**11**	**195**
Lime, sandy	**125**	**320**
Break of slate	**3**	**323**
Lime, sandy	**52**	**375**
Break of slate	**3**	**378**
Lime, sandy	**62**	**440**
Lime	**44**	**484**
Coal, Coalburg	**8**	**492**
Slate	**30**	**522**
Lime	**18**	**540**
Sand	**20**	**560**
Slate and shells	**20**	**580**
Lime, broken up	**50**	**630**
Slate	**70**	**700**
Slate, broken up	**80**	**780**
Sand	**20**	**800**
Slate	**60**	**860**
Slate, broken up	**65**	**925**
Sand	**15**	**940**
Slate	**50**	**990**
Sand, Rosedale Gas	**130**	**1120**
Lime, black	**48**	**1168**
Sand	**6**	**1174**
Slate	**11**	**1185**
Sand, Rosedale Salt (big water, 1250')	**65**	**1250**

	Thickness. Feet.	Total. Feet.
Unrecorded	587	1837
Big Lime	95	1932
Sand, Keener and Big Injun	80	2012

"Initial daily oil production in Big Injun Sand, 3 barrels; now (October 15, 1915) 1½ barrels daily. 10" casing, 65'; 8" casing, 675'."

The above well, the elevation of which was determined by Gawthrop, starts 180 feet above the Upper Kittanning Coal. The three great sandstone cliff-formers along the hillsides of Elk River in the immediate region; viz, Upper East Lynn, East Lynn, and Homewood, appear to be represented only by sandy lime and slate. This is an east edge well, the top of the Big Injun Sand having dipped down to about 822 feet below sea-level as against 760 feet below the same datum in **well No. 142 on Map II,** described on preceding pages and listed in the table of wells for Clay County.

The **Betty G. Bell No. 2 well—No. 154 on Map II—** located on the waters of Birch Run, 0.3 mile southeast of the well last described, drilled by the Davenport Oil and Gas Company, and its elevation determined by Gawthrop, had an initial daily oil production of 4 barrels from the Big Injun Sand, and was still making on October 8, 1915, 2 barrels daily. Its log was not obtained.

Frank Cox No. 1 Well Record (No. 155 on Map II).

Union District, on head of Camp Creek, 1.2 miles northeast of Bomont; well by Davenport Oil and Gas Company; authority, H. B. Davenport; completed, July 15, 1912; elevation, 1155' B.

	Thickness. Feet.	Total. Feet.
Soil	11	11
Sand	219	230
Coal, Upper Kittanning	4	234
Lime, black	66	300
Sand, Upper East Lynn	50	350
Slate	10	360
Sand, East Lynn and Homewood	150	510
Coal, Stockton	2	512
Lime, black	32	544
Coal, Coalburg	4	548
Lime, black	42	590
Sand	90	680
Lime	25	705
Slate and shells	155	860
Sand	60	920

PLATE XV.—Another view of topography of Allegheny and Kanawha Measures along Elk River in Groves, Clay County, region.

	Thickness. Feet.	Total. Feet.
Slate and shells	140	1060
Sand, Rosedale Gas (slate break, 1105-1107'; oil show, 1110-1130')	115	1175
Slate and shells	60	1235
Sand, Rosedale Salt (gas, 1270'; water, 1284', 1340'; big water, 1460')	339	1574
Slate (bad cave)	15	1589
Lime (cave)	11	1600
Sand	45	1645
Red rock	35	1680
Slate and shells	75	1755
Sand, Maxton	55	1810
Slate	4	1814
Little Lime	36	1850
Slate, Pencil, and shells	20	1870
Big Lime	100	1970
Sand, Keener (gas, 1970-2005')	35	2005
Slate break	1	2006
Sand, Big Injun	51	2057

"Details of Big Injun Sand: Sand, 1st oil pay, 2025-2029'; second oil pay, 2030-2037'; third oil pay, 2044-2049'; red rock to bottom, 2049-2057'. Initial oil production, 6 barrels daily; now (October 15, 1915) 3 barrels daily. Conductor, 11'; 10" casing, 64'; 8¼" casing, 640'; 6⅝" casing, 1597'; 5$\frac{3}{16}$" casing, 1880'; all pulled except 10" and 5$\frac{3}{16}$"."

The above well, the elevation of which was determined by Gawthrop, starts about 230 feet above the horizon of the Upper Kittanning Coal. The three great sandstone ledges, reported absent in the log previously described, are represented in normal development, the East Lynn and Homewood having coalesced and cut away the No. 5 Block Coal bed. A showing of oil was encountered in the Rosedale Gas Sand in this well and several others in this field, but thus far oil has not been found in it in paying quantities.

Frank Cox No. 6 Well Record (No. 156 on Map II).

Union District, on head of branch of Porter Creek, 0.8 mile northeast of Bomont; well by Davenport Oil and Gas Company; authority, H. B. Davenport; completed, May 19, 1913; elevation, 1124'.

	Top. Feet.	Bottom. Feet.
Big Lime	1837	1939
Sand, Keener (250,000 cu. ft. of gas)	1939	1968
Slate	1968	1970
Sand, Big Injun, to bottom	1970	2031

"Details of Big Injun Sand: First oil pay, 1992-1999½'; second oil pay, 2001-2016'; has produced 15,000 barrels; initial production, 32 barrels daily; now (October 15, 1915) 10 barrels daily; was making 25 barrels daily at end of first year; was shot with 20-quart shell December 4, 1913; with 30-quart shell, June 3, 1914. 10" casing, 20'; 8¼" casing, 570'; 6⅝" casing, 1837'; pulled 8¼" casing."

The above well, the elevation of which was determined by Gawthrop, starts about 210 feet above the horizon of the Upper Kittanning Coal bed.

E. W. King No. 9 Well Record (No. 157 on Map II).

Union District, Clay County, on south edge of ridge road, 0.6 mile northwest of Birch; by Ohio Fuel Oil Company; authority, H. B. Davenport; elevation, 1034' L.

	Top.	Bottom.
	Feet.	Feet.
Big Lime	1751	1846
Keener Sand (gas at 1871')	1846	1882
Break of slate (2")	1882	1882.2
Big Injun Sand: to red rock at bottom	1882.2	1933
Sand, blue, and hard	1846	1858
Sand, white and pebbly	1858	1861
Sand, white and hard	1861	1870
Sand, white and pebbly (gas at 1871')	1870	1882
Sand, white and very hard	1882	1911
Sand, white and coarse (oil show at 1913-1916')	1911	1916
Sand, blue and coarse, with large red and yellow pebbles	1916	1923
Sand, blue and finer, bottom very coarse, large pebbles, best oil show in bottom	1923	1933

"Shot with 120 quarts nitroglycerine (27-ft. shell) on March 1, 1915, and showed 1300 feet of fluid in hole next morning. Only making 1½ barrels of oil daily on November 15, 1915."

The above well starts 90 to 100 feet above the Upper Kittanning Coal bed.

M. J. and E. W. King No. 2 Well Record (No. 158 on Map II).

Union District, Clay County, on west hillside, at head of Birch Run, 1.1 miles northeast of Bomont; authority, Ohio Fuel Oil Company; completed, November 15, 1912; elevation, 1224' L.

	Thickness.	Total.
	Feet.	Feet.
Slate and shells	300	300
Coal, Upper Kittanning (914' L.)	5	305
Slate and shells	295	600
Coal, Coalburg	10	610
Slate and shells	40	650
Sand	150	800
Coal, Chilton (419' L.)	5	805

	Thickness. Feet.	Total. Feet.
Sand	55	860
Slate	5	865
Sand	35	900
Lime	10	910
Slate and shells	30	940
Sand	80	1020
Lime shells	10	1030
Slate	30	1060
Lime shells	60	1120
Sand, Rosedale Gas	70	1190
Slate	10	1200
Sand	40	1240
Shale	66	1306
Sand, Rosedale Salt	214	1520
Slate	20	1540
Sand	75	1615
Slate cave	8	1623
Sand	15	1638
Cave	12	1650
Sand	35	1685
Lime, white	15	1700
Red rock	70	1770
Slate	28	1798
Sand, Maxton	60	1858
Slate	8	1866
Little Lime	22	1888
Slate	2	1890
Lime	25	1915
Pencil Cave	20	1935
Big Lime	99	2034
Sand, Keener	24	2058
Break	2	2060
Sand, Big Injun, to bottom (oil pay, 2096-2118')	58	2118

8¼" casing, 644'; 6⅝" casing, 1660'; 5 3/16" casing, 1938'; all casing left in well.

The above well, the elevation of which was obtained from the owners by Gawthrop, had an initial daily oil production of 5 barrels, and was still making 2 to 3 barrels daily on October 8, 1915. It starts 300 feet above horizon of the Upper Kittanning Coal; hence, the bed at that depth undoubtedly represents this seam.

M. J. and E. W. King No. 7 Well Record (No. 159 on Map II).

Union District, Clay County, on ridge road at head of Birch Run, one mile just north of east of Bomont; authority, Ohio Fuel Oil Company; completed, June 17, 1914; elevation, 1203′ L.

	Top. Feet.	Bottom. Feet.
Sand, Salt (water at 1465′)	1290	1535
Sand, Maxton	1810	1870
Little Lime	1874	1900
Pencil Cave	1920	1930
Big Lime (gas at 1942′)	1930	2024
Sand, Keener	2024	2055
Sand, Big Injun, (oil pay, 2080-2096′)	2055	2099
Total depth		2100

Casing record (all left in well): 10″, 19′; 8¼″, 704′; 6⅝″ 1650′; 5$\frac{3}{16}$″, 1942′.

The above well, the elevation of which was obtained from the owners by Gawthrop, starts about 280 feet above the horizon of the Upper Kittanning Coal bed. It had an initial daily oil production of 6 barrels and was still making on October 8, 1915, about 5 barrels daily.

M. J. and E. W. King No. 4 Well Record (No. 160 on Map II).

Union District, Clay County, on head of Birch Run, one mile east of Bomont; authority, Ohio Fuel Oil Company; completed, December 16, 1912; elevation, 1221′ L.

	Thickness. Feet.	Total. Feet.
Slate and shells	505	505
Coal, No. 5 Block	3	508
Slate and shells	42	550
Coal, Stockton	6	556
Slate and shells	20	576
Sand	9	585
Slate	15	600
Coal, Coalburg	7	607
Lime	33	640
Slate and shells	360	1000
Sand	60	1060
Slate and lime	80	1140
Sand, Rosedale Gas	10	1150
Slate and shells	110	1260
Sand	15	1275
Slate	20	1295
Sand, Rosedale Salt	180	1475
Slate	10	1485
Sand, Salt	35	1520
Slate	20	1540
Sand	35	1575

	Thickness. Feet.	Total. Feet.
Slate	15	1590
Sand	50	1640
Cave	15	1655
Sand	40	1695
Red rock	85	1780
Sand, Maxton	50	1830
Slate	55	1885
Little Lime	30	1915
Pencil Cave	20	1935
Big Lime	90	2025
Sand and lime	35	2060
Sand, Keener	34	2094
Sand, Big Injun (oil)	23	2117
Total depth		2120

Casing record (left in well): 6⅝", 1660'; 5$\frac{3}{16}$", 1953'.

The above well, the elevation of which was obtained by Gawthrop from the owners, starts 300 feet above the horizon of the Upper Kittanning Coal, so that the bed at 600 feet undoubtedly represents the "Dorfee" or Coalburg bed. It is an oil producer from the Big Injun Sand, but its initial production and present capacity were not learned.

The **Frank Cox No. 7 well—No. 161 on Map II**—located on the waters of Porter Creek, ¾ mile northeast of Bomont and completed by the Davenport Oil and Gas Company during 1915, had an initial daily oil production of 3 barrels, according to Gawthrop, and at the end of 3 months was still producing at the rate of 65 barrels monthly.

The **Frank Cox No. 5 well—No. 162 on Map II**—located one-eighth mile southeast of the well last described and completed by the same company during 1913, had an initial oil production of 15 to 20 barrels daily, according to Gawthrop, and was still producing oil in October, 1915.

C. P. Samples No. 3 Well Record (No. 163 on Map II).

Union District, Clay County, on head of an eastern branch of Porter Creek, 0.6 mile northeast of Bomont; drilled by Koontz Oil Company; authority, C. E. Krebs; completed, February 13, 1913; elevation, 930' B.

	Top. Feet.	Bottom. Feet.
Coal, Middle Kittanning	70	73
Coal, Coalburg (water at 330')	330	332
Sand, Rosedale Gas (oil at 925'; water at 930')	800	950

	Top. Feet.	Bottom. Feet.
Sand, Rosedale Salt (water at 1125'; hole full of water at 1265')	1000	1410
Red rock at 1410 and 1450		
Sand, Maxton	1535	1570
Little Lime	1575	1615
Shale, lime	1625	1633
Pencil Cave	1633	1639
Big Lime	1639	1735
Sand, Keener	1735	1755
Slate	1755	1760
Sand, Big Injun (gas at 1760-1765'; show of oil, 1795-1800')	1760	1815
Red rock to bottom	1815	1821

10" casing, 85'; 8" casing, 490'; pulled 6⅝" casing, 1639'. Well was shot February 15, 1913, with 80 quarts; top of shot, 1785'; bottom, 1805'.

The above well, the elevation of which was determined by Gawthrop, starts 15 feet above the horizon of the Upper Kittanning Coal bed, and had an initial daily oil production of 3 barrels and was still making oil in October, 1915.

C. P. Samples No. 1 Well Record (No. 164 on Map II).

Union District, Clay County, on head of an eastern branch of Porter Creek, 0.6 mile just north of east of Bomont; drilled by Koontz Oil Company; authority, C. E. Krebs; completed, April 4, 1912; elevation, 950' B.

	Top. Feet.	Bottom. Feet.
Coal, Coalburg	290	295
Sand, Rosedale Gas and Salt (oil at 865', 915', and 950')	840	1440
Slate and red rock	1440	1447
Red rock (also at 1540')	1470	1490
Sand, Maxton	1560	1600
Little Lime	1606	1636
Pencil Cave	1636	1643
Pencil Cave	1653	1670
Big Lime (gas at 1735' and 1750'; oil at 1763')	1670	1765
Sand, Keener, (gas, 1788-1790')	1765	1790
Slate	1790	1792
Sand, Big Injun	1792	1845
Red rock to bottom	1845	1853

"First oil at 1811'; pay at 1818-1830'; gas at 1820'. 10" casing, 30'; 8" casing, 505'; 6⅝" casing, 1670'. Well was shot, April 11, 1912, with 50 quarts; top of shot at 1810'."

The above well, the elevation of which was determined by Gawthrop, had an initial daily oil production of 40 barrels and was still making 11 barrels daily in October, 1915. It starts about 30 feet above the horizon of the Upper Kittanning Coal.

C. P. Samples No. 4 Well Record (No. 165 on Map II).

Union District, Clay County, on head of an eastern branch of Porter Creek, 0.7 mile just north of east of Bomont; drilled by Koontz Oil Company; authority, C. E. Krebs; completed, May 17, 1913; elevation, 1025′ B.

	Top. Feet.	Bottom. Feet.
Coal, Upper Kittanning	125	
Coal, Coalburg, (water at 250′)	396	
Sand, Rosedale Gas (show of oil at 935′)	910	1030
Sand, Rosedale Salt	1070	1220
Slate	1220	1225
Sand, Salt (water, 1185′; hole full of water at 1310′)	1225	1505
Red rock	1505	1515
Sand, Maxton	1635	1670
Little Lime	1676	1707
Slate and lime shells	1709	1724
Pencil Cave	1724	1742
Big Lime (a little gas at 1822′)	1742	1842
Sand, Big Injun (gas at 1865-1872′; show of oil at 1906-1916′)	1842	1921
Red rock to bottom	1921	1925

10″ casing, 28′; 8″ casing, 540′; 6⅝″ casing, 1749′. Shot with 20 quarts, top of shot at 1908′; shot with 60 quarts on May 27, 1913, top of shot, 1888′.

The above well, the elevation of which was determined by Gawthrop, starts about 125 feet above the horizon of the Upper Kittanning Coal, and, according to the latter, was plugged and abandoned as non-paying, since it showed for only ½ barrel of oil daily.

The **C. P. Samples No. 7 well—No. 166 on Map II**—located on the waters of Porter Creek, 0.7 mile slightly north of east from Bomont, at an elevation of 1025′ B., as determined by Gawthrop, and completed by the Chalmers Oil and Gas Company, November 11, 1915, was the largest initial oil producer that had ever been drilled in Clay County. According to Henry B. Davenport, it made 92 barrels of oil the first 24 hours from the Big Injun at 61 feet in the sand, after drilling 4 feet into the pay streak. No log was obtained for this well.

C. P. Samples No. 5 Well Record (No. 167 on Map II).

Union District, Clay County, on the head of a branch of Porter Creek, 0.8 mile northeast of Bomont; drilled by Koontz Oil Company; authority C. E. Krebs; completed, February, 1914; elevation, 1130' B.

	Thickness. Feet.	Total. Feet.
Sand, shells, and shale	212	212
Coal, Upper Kittanning	4	216
Sand and shells	193	409
Coal, No. 5 Block	5	414
Slate	2	416
Sand and lime	50	466
Coal, Stockton	4	470
Sand	20	490
Shale	10	500
Coal, Coalburg, "Dorfee"	4	504
Slate	26	530
Lime	90	620
Sand	5	625
Slate	5	630
Lime	28	658
Slate	12	670
Sand	50	720
Slate	15	735
Lime	25	760
Sand	30	790
Lime	50	840
Sand	20	860
Slate and shells	115	975
Lime shells	65	1040
Sand, Rosedale Gas (gas at 1070')	95	1135
Slate	90	1225
Sand, Rosedale Salt (water at 1260'; hole full of water at 1450')	345	1570
Slate	8	1578
Lime, black	7	1585
Sand	45	1630
Red rock and lime shells	115	1745
Sand, Maxton	45	1790
Slate	6	1796
Little Lime	24	1820
Pencil Cave	40	1860
Big Lime (show of oil and gas at 1950-1955')	95	1955
Slate	8	1963
Big Injun Sand (gas at 1976'; show of oil at 1998'; oil pay, 2009-2019') to bottom	56	2019

10" casing, 38'; 8" casing, 662'; 6⅝" casing, 1718'.

The above well, according to information furnished Gawthrop, had an initial daily oil production of 35 barrels from the Big Injun Sand. The interval between the Upper

Kittanning and No. 5 Block Coals has increased to that normally found on Leatherwood, Middle, and Sycamore Creeks, in southern Clay County.

M. J. and E. W. King No. 1 Well Record (No. 168 on Map II).

Union District, Clay County, on head of a branch of Porter Creek, 0.8 mile east of Bomont; authority, Ohio Fuel Oil Company; completed, January, 1912; elevation, 1198' L.

	Thickness. Feet.	Total. Feet.
Clay	11	11
Sand, Mahoning	89	100
Slate	10	110
Lime	60	170
Sand, Lower Freeport	80	250
Lime	150	400
Sand, East Lynn	85	485
Coal, "No. 5 Block" (710' L.)	3	488
Sand, Homewood	72	560
Coal, Stockton (632' L.)	6	566
Sand, Upper Coalburg	64	630
Slate	5	635
Black sand	75	710
Lime shells	340	1050
Slate	62	1112
Sand, Rosedale Gas	88	1200
Slate	2	1202
Salt Sand, Rosedale	373	1575
Slate	5	1580
Sand	54	1634
Cave	6	1640
Sand	35	1675
Slate	17	1692
Lime	8	1700
Red rock	70	1770
Maxton Sand	30	1800
Slate	20	1820
Lime	25	1845
Slate and shells	25	1870
Little Lime	25	1895
Pencil Cave	17	1912
Big Lime	118	2030
Keener Sand	40	2070
Big Injun Sand (oil pay, 2076-2094')	32	2102
Total depth		2104

Casing record: 6⅝", 1640'; $5\frac{3}{16}$", 1920'.

The above well, the elevation of which was obtained from the owners by Gawthrop, starts about 280 feet above the horizon of the Upper Kittanning Coal, and includes 100 to 110 feet of the Conemaugh Series. It had an initial daily oil production of 25 barrels from the Big Injun Sand.

The detailed log of the **M. J. and E. W. King No. 6 well—No. 169 on Map II**—is published in Chapter IV in connection with the Bomont—One Mile Due East Section, pages 161-2. This record is very complete and of special interest as regards the correlation of the coals at the base of the Allegheny Series and the upper portion of the Kanawha Group. According to data furnished Gawthrop on October 8, 1915, the well had an initial daily oil production of 5 barrels from the Big Injun Sand and was still making 3 barrels daily.

The well of which the following is the record was examined by Gawthrop. It starts 197 feet above the horizon of the Upper Kittanning Coal bed:

M. J. and E. W. King No. 5 Well Record (No. 170 on Map II)

Union District, Clay County, on branch of Upper Birch Run, 1 mile east of Bomont; authority, Ohio Fuel Oil Co.; completed, May 31, 1913; elevation, 1131' L.

	Thickness. Feet.	Total. Feet.
Clay	3	3
Sand	197	200
Coal and slate, (Upper Kittanning) (911' L.)	20	220
Sand	110	330
Coal and slate, "No. 5 Block" (791' L.)	10	340
Lime	130	470
Slate	30	500
Coal, Coalburg (626' L.)	5	505
Lime	20	525
Slate	25	550
Lime	25	575
Slate	5	580
Sand	40	620
Slate	25	645
Sand	23	668
Slate	22	690
Lime	15	705
Slate	35	740
Sand	40	780
Slate	4	784
Sand	16	800
Slate	30	830
Sand	15	845
Slate	100	945
Lime	25	970
Slate	38	1008
Lime	12	1020
Sand, Rosedale Gas	40	1060

	Thickness. Feet.	Total. Feet.
Slate	5	1065
Sand	4	1069
Slate	2	1071
Sand	29	1100
Slate	5	1105
Sand	40	1145
Lime	35	1180
Slate	5	1185
Lime	15	1200
Salt Sand, Rosedale	310	1510
Slate	5	1515
Lime	108	1623
Red rock	42	1665
Lime	45	1710
Break	15	1725
Red rock	10	1735
Maxton Sand	45	1780
Little Lime	82	1862
Pencil Cave	9	1871
Big Lime	104	1975
Keener Sand (oil and gas at 1992′)	17	1992
Big Injun Sand	44	2036
Red rock to bottom	2	2038

10″ casing 20′; 8¼″ casing, 1358′ (pulled); 6⅝″ casing, 1871′.

W. D. Samples No. 1 Well Record (No. 171 on Map II).

Union District, Clay County, on ridge, 0.6 mile east of Bomont; drilled by Chalmers Oil and Gas Co.; authority, C. E. Krebs; completed, May 31, 1912; elevation, 1140′ B.

	Top. Feet.	Bottom. Feet.
Water	400	
Salt Sand (water at 850′ and 1250′; oil at 1145′ and 1400′; water at 1475′, hole full)	1020	1520
Red rock	1650	
Maxton Sand	1753	1790
Little Lime	1795	1830
Pencil Cave	1830	1857
Big Lime	1857	1965
Big Injun Sand	1965	1990
Slate	1990	1993
Big Injun Sand (gas at 1994′; oil pay, 2015′-2025′)	1993	2035
Red rock to bottom	2035	2044

Conductor, 8′; 10″ casing 46; 8″ casing, 710′; 6⅝″ casing, 1857′. Shot, June 5, 1912, with 40 quarts; top of shot, 2012 feet.

The above well, examined by Gawthrop, starts about 215 feet above the Upper Kittanning Coal bed.

Sidney Samples No. 1 Well Record (No. 172 on Map II).

Union District, Clay County, on branch of Porter Creek, 0.5 mile southeast of Bomont; drilled by Clay County Oil and Gas Co.; authority, H. B. Davenport; completed, September 25, 1911; elevation, 970' B.

			Thickness. Feet.	Total. Feet.
Coal, Stockton, at				310
Unrecorded			1683	1683
Big Lime (gas at 1780')			100	1783
Sand, hard and white	10'	**Keener**	26	1809
Sand, blue and hard	6			
Sand, blue and soft (first gas pay, 1800-1805')	8			
Sand, soft	2			
Slate, break			6	1815
Sand, large pebbles	5	**Big Injun** (41)	40	1855
Sand, white	4½			
Sand, (gas pay)	1½			
Sand, hard	9			
Sand, (oil pay)	6			
Sand	13			
Sand, dark	2			
Sand, red			1½	1856½

"Conductor, 28'; 8" casing, 570'; 6⅝" casing, 1683'. This well is good for 30 to 40 barrels per day."

The above well, the elevation of which was determined by Gawthrop, starts about 40 feet above the horizon of the Upper Kittanning Coal bed.

H. M. Minner No. 2 Well Record (No. 173 on Map II).

Union District, Clay County, on branch of Porter Creek, 0.5 mile southeast of Bomont; authority, Ohio Fuel Oil Company; completed, October 4, 1912; elevation, 965' L.

	Thickness. Feet.	Total. Feet.
Clay	15	15
Sand, Upper East Lynn	111	126
Slate	6	132
Sand, East Lynn	68	200
Slate and shells	26	226
Sand, Homewood	96	322
Slate	11	333
Sand	137	470
Coal, Chilton (490' L.)	5	475
Sand	205	680
Slate and shells	120	800
Lime	40	840
Sand	110	950
Slate and shells	70	1020

	Thickness. Feet.	Total. Feet.
Sand	326	1346
Slate	6	1352
Sand	53	1405
Slate	20	1425
Sand	37	1462
Slate	8	1470
Red rock	25	1495
Slate	7	1502
Red rock	6	1508
Slate	7	1515
Lime shells	5	1520
Red rock	10	1530
Lime shells	7	1537
Red rock	23	1560
Maxton Sand	30	1590
Break	2	1592
Lime shells	8	1600
Slate	6	1606
Little Lime	20	1626
Slate	4	1630
Lime shells	13	1643
Slate	2	1645
Lime shells	5	1650
Pencil Cave	15	1665
Big Lime	95	1760
Keener Sand	50	1810
Break	5	1815
Big Injun Sand	20	1835
Total depth		1839

8¼" casing 530'; 6⅝" casing, 1665'. Initial oil production, 7½ barrels daily from Big Injun Sand, now (October 8, 1915) 2 barrels daily.

The above well starts 15 to 20 feet above the horizon of the Upper Kittanning Coal bed.

H. M. Minner No. 3 Well Record (No. 174 on Map II).

Union District, Clay County, on head of branch of Porter Creek, 0.6 mile southeast of Bomont; authority, Ohio Fuel Oil Company; completed, October 4, 1912; elevation, 1092' L.

	Thickness. Feet.	Total. Feet.
Clay	12	12
Sand	948	960
Lime and slate	190	1150
Salt Sand, Rosedale (hole full of water at 1400')	325	1475
Slate and shells	35	1510
Lime	15	1525
Sand	50	1575
Red rock	65	1640
Lime shells	15	1655

	Thickness. Feet.	Total. Feet.
Red rock	45	1700
Lime	25	1725
Maxton Sand	20	1745
Slate	10	1755
Little Lime	20	1775
Pencil Cave	20	1795
Big Lime	115	1910
Keener Sand	30	1940
Slate	11	1951
Big Injun Sand	24	1975
Unrecorded to bottom	9	1984

8¼" casing, 535' (pulled); 6⅝" casing, 1797' (left in).

The above well, according to information given Gawthrop, had an initial daily oil production of 5 barrels and was still making 1 barrel daily on October 8, 1915. It starts about 155 feet above the horizon of the Upper Kittanning Coal bed.

The well, the record of which is given next below, was examined by Gawthrop, who reports it having an initial production of 15 barrels of oil daily from the Big Injun Sand and still making 3 barrels daily on October 8, 1915. It starts about 110 feet above the horizon of the Upper Kittanning Coal bed, the driller failing to record the latter, if present:

H. M. Minner No. 1 Well Record (No. 175 on Map II).

Union District, Clay County, on head of branch of Porter Creek, 0.6 mile southeast of Bomont; authority, Ohio Fuel Oil Company; completed, January 24, 1912; elevation, 1035' L.

	Thickness. Feet.	Total. Feet.
Clay	15	15
Sand, Lower Freeport	70	85
Shale	30	115
Sand, Upper East Lynn	100	215
Coal, Middle Kittanning (817' L.)	3	218
Sand, East Lynn and Homewood	142	360
Coal, Stockton (672' L.)	3	363
Shale	7	370
Sand	160	530
Broken sand	22	552
Sand	68	620
Blue sand	12	632
Lime	18	650
Sand	50	700
Shale	23	723
Lime	17	740
Shale	44	784
Lime	9	793

	Thickness. Feet.	Total. Feet.
Shale	27	820
Sand	12	832
Shale	58	890
Lime	20	910
Sand, Rosedale Gas	168	1078
Shale	22	1100
Salt Sand, Rosedale	347	1447
Sand lime	43	1490
Lime	33	1523
Sand	25	1548
Red rock	54	1602
Lime shell	6	1608
Dark shale	12	1620
Red rock	40	1660
Shale	10	1670
Sandy lime	23	1693
Shale	3	1696
Lime	24	1720
Shale	4	1724
Lime	4	1728
Shale	8	1736
Lime	8	1744
Pencil Cave	11	1755
Big Lime	101	1856
Big Injun Sand	10	1866
Blue sand	7	1873
Soft sand	8	1881
Shale	6	1887
Sand	13	1900
Oil pay	17	1917
Unrecorded to bottom	1	1918

10" casing, 295' (pulled); 8¼" casing, 636' (pulled); 6⅝" casing, 1755' (left in).

The **Melzie Moore No. 1 Well—No. 176 on Map II**—located just on the east side of the ridge, 0.8 mile southeast of Bomont, in Union District, Clay County, at an elevation of 1140' B., as determined with aneroid by Gawthrop, was a Big Injun oil producer, according to information given him, making 3 to 5 barrels daily when completed in 1913 and still producing 1 barrel daily on October 8, 1915.

The **P. N. King No. 4 well—No. 177 on Map II**—located on ridge, 0.8 mile east of Bomont, and completed during 1914 by the Chalmers Oil and Gas Company, is a Big Injun oil producer. It had an initial daily production of 6 to 8 barrels and was still making 4 barrels daily on October 19, 1915, according to information obtained by Gawthrop.

The well, the log of which is given next below, starts about 70 feet above the horizon of the Upper Kittanning Coal, and is a Big Injun oil producer. It had an initial daily production of 12 barrels and was still making 5 barrels daily on October 19, 1915:

M. J. and E. W. King No. 3 Well Record (No. 178 on Map II).

Union District, Clay County, on branch of Upper Birch Run, 1 mile just south of east from Bomont; authority, Ohio Fuel Oil Company; completed, October 24, 1912; elevation, 1000′ L.

	Thickness. Feet.	Total. Feet.
Clay	4	4
Sand	56	60
Slate	10	70
Coal, Upper Kittanning	2	72
Slate	8	80
Sand, Upper East Lynn	45	125
Slate	25	150
Sand, East Lynn	125	275
Coal, "No. 5 Block"	4	279
Slate	101	380
Sand	80	460
Slate and shells	90	550
Sand	40	590
Black slate (400′ L.)	10	600
Sand	40	640
Slate	12	652
Sand	20	672
Slate	6	678
Sand	32	710
Slate and shells	90	800
Black lime	110	910
Sand, Rosedale Gas	115	1025
Slate and shells	35	1060
Salt Sand, Rosedale	340	1400
Break	5	1405
Lime	70	1475
Sand	30	1505
Red rock	70	1575
Lime	20	1595
Red rock	20	1615
Slate	5	1620
Maxton Sand	40	1660
Slate	5	1665
Little Lime	40	1705
Pencil Cave	5	1710
Big Lime	146	1856
Keener Sand	20	1876
Break of slate	2	1878
Big Injun Sand	23	1901
Slate to bottom	3	1904

8¼″ casing, 380′ (pulled); 6⅝″ casing, 1718′ (left in).

James Connell Heirs No. 7 Well Record (No. 179 on Map II).

Union District, Clay County, on branch of Upper Birch Run, 1.1 miles southeast of Bomont; drilled by Birch Run Oil Company; authority, L. V. Koontz; completed, August 23, 1913; elevation, 950′ B.

	Top. Feet.	Bottom. Feet.
Coal, Stockton	250	255
Coal, Coalburg	310	315
Coal, Winifrede	400	405
Coal, Williamson?	552	555
Sand, Rosedale Gas (show of oil and water at 910-915′)	830	985
Sand, Rosedale Salt (water at 1245′)	1000	1380
Red rock and shells	1455	1570
Sand, Maxton	1570	1606
Little Lime	1606	1646
Slate and pencil	1646	1667
Big Lime (gas at 1750′)	1667	1776
Sand, Big Injun (gas at 1786-1795′) (sand, soft, pebbly, 1825-1840′; show of oil at 1830-1836′)	1776	1855
Red rock (show) at bottom of hole		1855

10″ casing, 22′; 8″ casing, 513′ (pulled); 6⅝″ casing, 1457′; 5$\frac{3}{16}$″ casing, 1678′. Well was shot with 40 quarts on August 30, 1913; top of shot at 1825′, bottom, 1838½′.

The above well, the elevation of which was determined by Gawthrop, starts about 15 feet above the horizon of the Upper Kittanning Coal. It had an initial daily oil production of only one barrel and was still making slightly over a half barrel daily on October 19, 1915.

The well, the log of which is given next below, starts 95 to 100 feet below the horizon of the Upper Kittanning Coal, according to the elevation determined by Gawthrop:

James Connell Heirs No. 5 Well Record (No. 180 on Map II).

Union District, Clay County, on branch of Upper Birch Run, 1 mile southeast of Bomont; drilled by Birch Run Oil Company: authority, L. V. Koontz; completed, April 3, 1913; elevation, 1025′ B.

	Top. Feet.	Bottom. Feet.
Coal, Middle Kittanning (water)	180	
Coal, No. 5 Block	300	
Coal, Coalburg	400	
Sand, Rosedale Gas and Salt	945	1520
Red rock	1520	1540
Cave	1615	1623
Maxton Sand	1623	1673
Pencil Cave	1673	1680

	Top. Feet.	Bottom. Feet.
Little Lime	1680	1710
Slate and Pencil	1710	1715
Lime shell	1715	1720
Slate and Pencil	1720	1746
Big Lime (a little gas at 1805')	1746	1850
Sand, Big Injun (gas at 1865' and 1885'; first oil at 1895'; 2nd oil at 1906'; pay at 1906-1920') to bottom	1850	1926

10" casing, 25'; 8" casing, 630' (pulled); 6⅝" casing, 1623' (pulled); 5 3/16" casing, 1750'. Well was shot with 4"x7½' shell—30' anchor. Top of shot at 1888½'; bottom—1896'. Initial oil production, 40 barrels daily, now (October 19, 1915), making 3 barrels daily.

The well, the log of which is given next below, starts about 280 feet above the horizon of the Upper Kittanning Coal, according to the elevation determined with aneroid by Gawthrop. It had an initial daily oil production of 15 barrels and was still making 3 barrels daily on October 19, 1915:

James Connell Heirs No. 8 Well Record (No. 181 on Map II).

Union District, Clay County, on north hillside of Upper Birch Run, one mile west of Birch; drilled by Birch Run Oil Company; authority, L. V. Koontz; completed, July 12, 1913; elevation, 1220' B.

	Top. Feet.	Bottom. Feet.
Coal, Coalburg, (water at 565')	565	570
Coal, Chilton	710	715
Coal, Williamson?	795	800
Coal, Cedar Grove?	850	852
Sand, Rosedale Gas and Salt (water at 1370')	1066	1442
Sand, Salt (hole full of water at 1525')	1448	1600
Red rock and shells	1740	1835
Sand, Maxton	1840	1870
Little Lime	1875	1905
Slate and pencils	1905	1940
Big Lime	1940	2037
Sand, Keener (gas at 2052')	2037	2053
Slate, break	2053	2055
Sand, Big Injun (gas at 2062', 2080', 2090'; 1st oil, 2091'; pay 2091-2100') to bottom	2055	2117

10" casing, 38'; 8" casing, 810' (pulled); 6⅝" casing, 1648'; 5 3/16" casing, 1944'. Well was shot with 20 quarts, July 19, 1913. Top of shot at 2090'—bottom, 2097½'.

James Connell Heirs No. 9 Well Record (No. 182 on Map II).

Union District, Clay County, on ridge, north side of Upper Birch Run, 0.9 mile southeast of Bomont; drilled by Birch Run Oil Company; authority, L. V. Koontz; completed, February 27, 1914; elevation, 1190′ B.

	Top. Feet.	Bottom. Feet.
Coal, Upper Kittanning	255	260
Coal, Stockton	505	
Coal, Chilton?	735	738
Sand, Rosedale Gas (show of oil at 1090′)	1070	1160
Sand, Rosedale Salt (water at 1215′, 1440′, and 1480′)	1185	1572
Sand, Salt	1607	1682
Red rock	1700	1780
Sand, Maxton	1810	1842
Little Lime	1845	1880
Sand	1885	1900
Pencil Cave	1900	1912
Big Lime	1912	2008
Sand, Keener	2008	2028
Slate	2028	2029
Sand, Big Injun (gas at 2030′; oil at 2068′; pay, 2068-2078′)	2029	2083
Red rock to bottom	2083	2085

10″ casing, 57′; 8″ casing, 800′; 6⅝″ casing, 1914′. Well shot with 40 quarts on March 2, 1914.

The above well, the elevation of which was obtained by Gawthrop, had an initial oil production of only 1½ barrels daily from the Big Injun Sand and was still making 1 barrel daily on October 19, 1915.

James Connell Heirs No. 10 Well Record (No. 183 on Map II).

Union District, Clay County, on branch of Upper Birch Run, 1.1 miles southeast of Bomont; drilled by Birch Run Oil Co.; authority, L. V. Koontz; completed, April 27, 1914; elevation, 970′ B.

	Top. Feet.	Bottom. Feet.
Coal, Upper Kittanning	16	20
Coal, Middle Kittanning	128	130
Coal, Stockton	276	282
Coal, Coalburg	320	324
Coal, Chilton?	440	445
Sand, Rosedale Gas	800	1050
Sand, Rosedale Salt (water at 1106′ and 1248′)	1052	1350
Cave	1350	1356
Sand, Salt (water at 1385′ and 1470′)	1356	1482
Red rock	1482	1492

	Top. Feet.	Bottom. Feet.
Sand, Maxton	1586	1626
Little Lime	1627	1667
Slate and shells	1667	1687
Pencil Cave	1687	1693
Big Lime (1st gas at 1766')	1693	1791
Sand, Keener (show of oil at 1796')	1791	1811
Slate	1811	1815
Sand, Big Injun, (gas at 1827' and 1834'), to bottom	1815	1838

10" casing, 32'; 8" casing, 602'; 6⅝" casing, 1356'; $5\frac{3}{16}$" casing, 1695'.

The above well, the elevation of which was determined by Gawthrop, starts just above the horizon of the Upper Kittanning Coal and is a strong gasser from the Big Injun Sand, having an initial daily production of over two million cubic feet, the output from which is used in the manufacture of carbon black in the plant at Birch, slightly over a mile eastward. This well, also the **James Connell Heirs No. 9—No. 184 on Map II**—¼ mile southwestward, is at the southern terminus of the apparent defined limits of the Big Injun Sand oil pool of the Marne-Bomont-Birch region. The latter well, visited by both Gawthrop and the writer, starts about 10 feet below the horizon of the Upper Kittanning Coal, and, according to the former, was completed 5 or 6 years ago and abandoned as a dry hole.

James Connell Heirs No. 6 Well Record (No. 185 on Map II).

Union District, Clay County, on ridge, one mile southeast of Bomont; drilled by Birch Run Oil Company; authority, L. V. Koontz; completed, April 16, 1913; elevation, 1210' B.

	Top. Feet.	Bottom. Feet.
Coal, Upper Kittanning	800	805
Coal, Williamson?	800	805
Sand, Rosedale Gas and Salt (show of oil at 1115')	1105	1605
Red rock	1755	1765
Sand, Maxton	1830	1862
Little Lime	1868	1888
Pencil Cave	1888	1927
Big Lime	1927	2035
Sand, Big Injun (a little gas at 2050' and 2088'; oil pay at 2089-2096')	2035	2110
Red rock to bottom	2110	2114

10" casing, 30'; 8" casing, 813' (pulled); 6⅝" casing, 1836' (pulled); $5\frac{3}{16}$" casing, 1945'. Well was shot with 40 quarts—18' anchor—on April 26, 1913. Top of shot at 2082½'; bottom, 2096'.

The above well, the elevation of which was determined by Gawthrop, starts about 300 feet above the horizon of the Upper Kittanning Coal bed, and had an initial daily oil production from the Big Injun Sand of 14 barrels and was still making 4 barrels daily on October 19, 1915.

The **James Connell Heirs No. 3 well—No. 186 on Map II**—located in Union District on the south side of the ridge, 0.9 mile southeast of Bomont and examined by Gawthrop, is a Big Injun Sand oil producer, according to him. It had an initial daily production of 9 barrels when completed by the Birch Run Oil Company in 1913, and was still making 4 barrels daily on October 19, 1915.

The **James Connell Heirs No. 4 well—No. 187 on Map II**—located 0.2 mile northeast of the well last described and examined by Gawthrop, had an initial daily oil production of 11 barrels when completed by the same company in 1912 and was still making 4 barrels daily on October 19, 1915.

The well, the log of which is given next below, starts about 100 feet above the horizon of the Upper Kittanning Coal, according to determinations made by Gawthrop, and is a Big Injun Sand oil producer, having an initial production of only 2 barrels daily and still making 1 barrel daily on October 19, 1915:

P. N. King No. 2 Well Record (No. 188 on Map II).

Union District, Clay County, on head of branch of Upper Birch Run, 0.7 mile just south of east from Bomont; drilled by the Koontz Oil and Gas Company; authority, C. E. Krebs; completed, August 3, 1912; elevation, 1020' B.

	Top. Feet.	Bottom. Feet.
Coal, Middle Kittanning	175	
Coal, Stockton	350	354
Coal, Winifrede (gas)	450	454
Coal, Chilton	525	530
Coal, Cedar Grove?	600	605
Sand, Rosedale Gas and Salt (gas at 890'; oil at 975'; water at 980', 1090' and 1345')	800	1415
Red rock	1450	1456
Sand, Maxton	1650	1692
Little Lime	1700	1730
Pencil Cave	1740	1755
Big Lime (gas at 1785')	1755	1844

	Top. Feet.	Bottom. Feet.
Sand, Big Injun (gas and oil at 1850'; gas at 1865-1880'; oil at 1888'; pay, 1895-1910')	1844	1912
Total depth		1914

10" casing, 53'; 8" casing, 600' (pulled); 6⅝" casing, 1461' (pulled); 5 3/16" casing, 1758'. Well was shot, August 7, 1912, with two 3½"x15' shells; top of shot at 1898'. Well was shot with 20 quarts on June 11, 1913; top of shot at 1877'.

Connell Heirs No. 1 Well Record (No. 189 on Map II).

Union District, Clay County, on ridge, 0.8 mile southeast of Bomont; drilled by the Raven Carbon Company; authority, H. B. Davenport; completed, April 29, 1911; elevation, 1140' B.

	Thickness. Feet.	Total. Feet.
Soil, etc. (conductor)	14	14
Sand, Upper Freeport	66	80
Slate	15	95
Sand, Lower Freeport	75	170
Slate	26	196
Coal, Upper Kittanning	4	200
Sand, Upper East Lynn, East Lynn, and Homewood (water enough to drill with at 290')	230	430
Slate	10	440
Sand (6 bailers of water at 480')	40	480
Slate, some **Coalburg Coal** at 500'	45	525
Sand	55	580
Sand and shells	60	640
Slate, black	30	670
Sand	60	730
Sandy shells	170	900
Slate	60	960
Shells (trace of oil at 1050')	90	1050
Sand, Rosedale Gas (show of oil and gas at 1105')	75	1125
Slate	5	1130
Sand, Rosedale Salt (water at 1230', 1295'; hole full of water at 1445')	400	1530
Slate	5	1535
Lime	5	1540
Sand, Salt	90	1630
Slate	2	1632
Sand, Maxton	18	1650
Lime	5	1655
Lime, red	30	1685
Shells	25	1710
Slate	5	1715
Shells	10	1725
Lime	15	1740
Slate	10	1750
Sand	25	1775
Slate, black	15	1790
Shells	35	1825
Slate, black	25	1850

	Thickness. Feet.	Total. Feet.
Lime	13	1863
Slate and shells	27	1890
Big Lime (show of gas at 1943')	68	1958
Sand, Keener	20	1978
Slate	12	1990
Sand, Big Injun (gas at 2000'; show of oil at 2008'; oil pay at 2012-2022')	45	2035
Red rock to bottom	3	2038

10" casing, 62'; 8¼" casing, 730'; 6⅝" casing, 1730'; 5$\frac{3}{16}$" casing, 1943'.

The above well, examined by Gawthrop, was the **first producer** obtained in the Big Injun oil pool of Union District, Clay County, according to Henry B. Davenport. It had an initial daily production of 24 barrels and was still making 2½ barrels daily on November 15, 1915. The boring starts about 200 feet above the horizon of the Upper Kittanning Coal, its log including the entire Allegheny Series. The Middle Kittanning and No. 5 Block Coal beds have been cut away entirely by the coalescing of the Upper East Lynn, East Lynn, and Homewood Sandstones, a feature that happens frequently at outcrop exposures along the valley walls of Elk River between Dundon and Queen Shoals.

Practically all of the 45 to 50 gas wells that had been completed in Union District, Clay County, at the end of the year 1915, obtained their production from the Keener and Big Injun Sands, with the latter zone predominating. A glance at the structure contours on Map II shows these wells at a higher level, as should be expected, than those in the Big Injun oil pool in the same District, described on preceding pages. The history and records of a number of the former will now be given.

L. H. Samples No. 1 Well Record (No. 146 on Map II).

Union District, on branch of Camp Creek, 1.6 miles due west of Rouzer; well by Eastern Carbon Black Co.; authority, H. B. Davenport; completed, August 28, 1915; elevation, 908' L.

	Top. Feet.	Bottom. Feet.
Big Lime	1594	1693
Sand, Keener (500,000 cu. ft. gas at 1705-1715')	1693	1723
Slate, break	1723	1725
Sand, Big Injun (gas, 1751-1764')	1725	1781
Red rock at bottom		1781

Details of Big Injun: Sand, soft, large white pebbles, some gas, 1725-1735'; sand, medium-hard, white, 1735-1743'; sand, medium-hard, white, pebbly, 1743-1751'; sand, gray, good, coarse, pebbly, ½ million cubic feet gas at 1751-1764'; sand, blue, 1764-1781'. Well tested four-tenths water (two each way) in Pitot tube in 6⅝" casing. 6⅝" casing, 1597'.

The above well, examined by Gawthrop, starts 15 to 20 feet above an opening in the Upper Kittanning Coal bed. The water-gauge test is equivalent to about one million cubic feet daily, the volume of gas being divided about equally between the Keener and Big Injun Sands. This well, as also the following, is located just on the east side of the crest of the Chestnut Ridge Anticline:

L. H. Samples No. 2 Well Record (No. 147 on Map II).

Union District, Clay County, on divide, 1.1 miles north of Bomont; by Eastern Carbon Black Co.; authority, H. O. Rea; elevation, 1180' B.

	Thickness. Feet.	Total. Feet.
Clay	42	42
Sand, Upper and Lower Freeport	158	200
Slate	50	250
Sand, Upper East Lynn, East Lynn, and Homewood	250	500
Slate	15	515
Coal, Coalburg (fresh water at 520')	5	520
Slate and lime	60	580
Sand	70	650
Slate and shell	365	1015
Sand, Rosedale Gas	105	1120
Slate	25	1145
Sand, Rosedale Salt (first water, 8 barrels, at 1260'; hole full of water at 1440')	465	1610
Slate	15	1625
Red rock and slate	100	1725
Sand, Maxton	40	1765
Slate	7	1772
Little Lime	31	1803
Slate and shell	7	1810
Pencil Cave	12	1822
Big Lime	100	1922
Sand, Keener (first gas at 1925')	23	1945
Break	3	1948
Sand, Big Injun (second gas at 1985')	55	2003
Unrecorded to bottom	2	2005

10" casing, 42'; 8" casing, 600'; 6½" casing, 1824'; packer with 3" tubing, 1885'; five joints below packer, 120'.

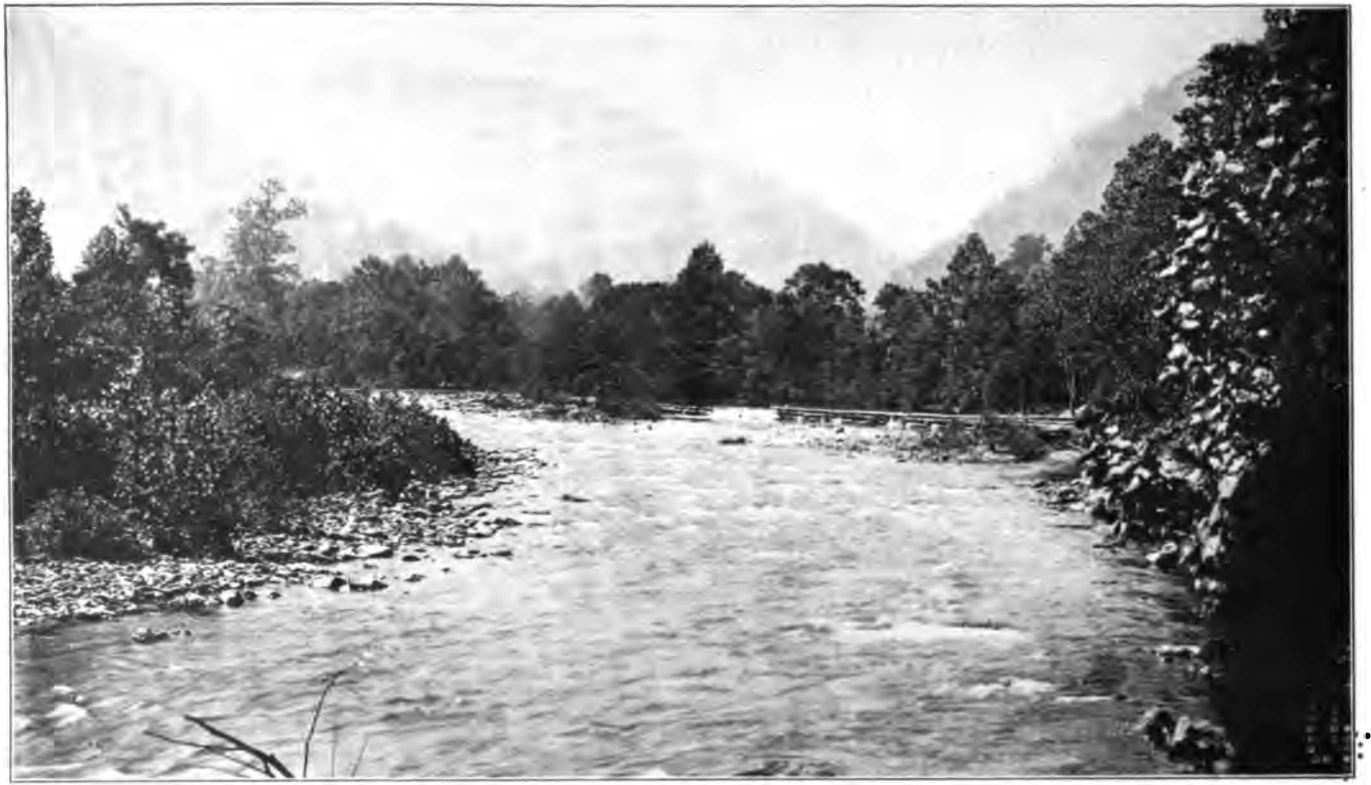

PLATE XVI.—View of Elk River looking southeastward up Laurel Creek, just below Centralia; topography of Allegheny and Kanawha Measures.

The above well, examined by the writer, starts about 250 feet above the horizon of the Upper Kittanning Coal bed, its log including the entire Allegheny Series and the coal seams of the latter not being recorded, if present. It is a gasser from both the Keener and Big Injun and had an initial volume on open flow of 3 million cubic feet daily, according to Henry B. Davenport.

The well, the log of which is given next below, is located along the east side of the crest of the Chestnut Ridge Anticline, and is a fine gasser from the Big Injun Sand. It starts, according to Gawthrop, almost flush with the crop of the Upper Kittanning Coal. The usual **oil show** is recorded in the **Rosedale Gas Sand,** as also a gas pay just above the middle of the Big Lime:

D. R. King No. 1 Well Record (No. 190 on Map II).

Union District, on head of branch of Porter Creek, 0.9 mile southwest of Bomont; well by Koontz Oil & Gas Co.; authority, H. B. Davenport; completed, January 12, 1909; elevation, 945' B.

	Thickness. Feet.	Total. Feet.
Gravel	8	8
Shale	2	10
Gravel	10	20
Sand, Upper East Lynn	120	140
Slate	5	145
Sand, East Lynn	35	180
Coal, "No. 5 Block"	5	185
Sand	15	200
Slate	20	220
Lime, black, probably Kanawha Black Flint	15	235
Slate, black	15	250
Lime, sandy	70	320
Sand	15	335
Lime	15	350
Sand	30	380
Slate, black	5	385
Sand	25	410
Slate	25	435
Coal, Chilton?	5	440
Slate	5	445
Sand	35	480
Slate	20	500
Sand	65	565
Slate	25	590
Sand	20	610
Slate, black	115	725
Lime	30	755

	Thickness. Feet.	Total. Feet.
Slate	25	780
Sand, Rosedale Gas (oil show, 817')	40	820
Slate	25	845
Lime, sandy	45	890
Sand	30	920
Slate	20	940
Lime	25	965
Sand, (water, 1020-70')..115' Sand, soft..110 Sand..85 } **Rosedale Salt**	310	1275
Lime and sand	15	1290
Sand, broken	15	1305
Pebbles	5	1310
Sand, hard	105	1415
Red rock	20	1435
Shale	30	1465
Lime, sandy	25	1490
Lime, hard	50	1540
Sand, hard, Maxton	25	1565
Slate	13	1578
Red rock	15	1593
Little Lime	22	1615
Pencil Cave	3	1618
Big Lime (gas, 1660')	107	1725
Sand, Big Injun (gas, 1736')	25	1750
Red rock to bottom	3	1753

4,000,000 cubic feet of gas daily in Big Injun. 10" casing, 20' 7"; 8" casing, 445' (pulled); 6⅝" casing, 1632'; 1 bottom hole lead packer.

The **Thos. King No. 1 well—No. 191 on Map II**—located 0.2 mile due north of the well last described and owned by the Public Oil and Gas Company, according to Gawthrop, who determined its elevation at 1125' B., had an initial gas volume of 1½ million cubic feet daily from the Big Injun Sand. No log was obtained for this boring.

W. H. Evans No. 1 Well Record (No. 192 on Map II).

Union District, on head of branch of Porter Creek, 0.5 mile southwest of Bomont; well by Eastern Carbon Black Co.; authority, H. B. Davenport; completed, 1911; elevation, 1010' B.

	Thickness. Feet.	Total. Feet.
Conductor	15	15
Sand, Lower Freeport (hole full of water at 67')	60	75
Slate	15	90
Sand, Upper East Lynn and East Lynn	130	220
Coal, "No. 5 Block"	4	224
Slate	26	250
Sand, Homewood	100	350

	Thickness. Feet.	Total. Feet.
Lime, black	140	490
Slate	10	500
Sand	80	580
Slate	40	620
Sand	80	700
Slate	70	770
Sand, Rosedale Gas	180	950
Slate	10	960
Sand, Rosedale Salt (water, 970'; hole full of water, 1145')	458	1418
Slate	2	1420
Sand	20	1440
Slate	20	1460
Lime	20	1480
Slate	15	1495
Sand, Maxton	35	1530
Slate	2	1532
Little Lime	45	1577
Pencil Cave	10	1587
Big Lime	133	1720
Sand, Big Injun (gas pay, 1732-1750')	35	1755
Slate and red rock to bottom	5	1760

10" casing, 80'; 8" casing, 525' (pulled); 6⅝" casing, 1600'. About 2,000,000 cubic feet of gas daily from Big Injun Sand.

The above well, the elevation of which was determined with aneroid by Gawthrop, starts about 75 feet above the horizon of the Upper Kittanning Coal bed and fails to record either the Stockton or Coalburg seams.

W. D. Samples No. 1 Well Record (No. 194 on Map II).

Union District, Clay County, on west bank of Porter Creek, ¼ mile southward from Bomont; owned by Public Oil & Gas Company; elevation, 847' L.

	Thickness. Feet.	Total. Feet.
Sand and gravel	8	8
Sand, Homewood	92	100
Black slate, hard, Kanawha Black Flint, very hard on bits	15	115
Sand	25	140
Coal, Stockton	5	145
Slate, black	20	165
Coal, Coalburg	5	170
Slate	40	210
Sand	40	250
Lime, hard	20	270
Slate	20	290
Sand	25	315
Slate	5	320

	Thickness. Feet.	Total. Feet.
Sand	25	345
Slate	35	380
Sand	5	385
Slate	5	390
Sand	80	470
Slate	15	485
Sand	20	505
Slate	45	550
Sand	100	650
Slate	15	665
Sand, Rosedale Gas	71	736
Gas	5	741
Oil	5	746
Slate	2	748
Sand	42	790
Slate	20	810
Shale, sandy	80	890
Lime, sandy	40	930
Sand, hard, Rosedale Salt (first water at 935'; second water at 1110'; hole full of water at 1125')	265	1195
Slate, black	30	1225
Lime	10	1235
Sand, pebbly 10' } Salt	65	1300
Sand 55 }		
Lime	5	1305
Red rock	5	1310
Lime	10	1320
Sand, broken	30	1350
Shale	5	1355
Lime	5	1360
Red rock	20	1380
Lime shells	10	1390
Sand, hard, Maxton	20	1410
Sand, soft	10	1420
Sand, hard	30	1450
Little Lime	30	1480
Slate, black	2	1482
Lime, black	3	1485
Slate	5	1490
Sand	10	1500
Pencil Cave	10	1510
Big Lime	45	1555
Sand, Keener	10	1565
Lime, white	50	1615
Top of Big Injun Sand	4	1619
First gas	16	1635
Second gas	11	1646
Bottom of Big Injun Sand	2	1648
Finished in soft red rock		1648

10" casing 80'; 8" casing, 397'; 6⅝" casing, 1513'.

The above well, examined by Gawthrop, starts 95 feet below an opening in the Upper Kittanning Coal bed, and, according to the latter, had an initial gas volume of 3 million cubic feet daily from the Big Injun Sand. The member at 100 feet from the top undoubtedly represents the **Kanawha Black Flint,** since its interval below the coal last mentioned agrees closely with that found at Queen Shoals, 3 miles northwestward, and the drillers report this formation as being very hard on the bits. Hence, the Stockton and Coalburg Coal seams at 140 and 165 feet, respectively, are correctly designated. The usual oil and gas shows are found in the Rosedale Gas Sand.

Harrison Samples Heirs No. 2 Well Record (No. 193 on Map II).

Union District, Clay County, on northeast bank of Porter Creek, 0.1 mile southeast of Bomont; drilled by the Clay County Oil & Gas Co.; authority, H. B. Davenport; completed, May 2, 1912; elevation, 844′ L.

	Top. Feet.	Bottom. Feet.
Big Lime (6⅝″ casing, 1512′)	1510	1610
Keener Sand (gas at 1614′)	1610	1644
Break	1644	1648
Big Injun Sand (gas pay, 1656-1676′)	1648	1680
Red rock to bottom	1680	1681

"Well good for about three million feet of gas."

The above well starts about 100 feet below the Upper Kittanning Coal bed.

The **W. D. Samples No. 2 Well—No. 195 on Map II**—located 0.2 mile due west of Bomont in Union District, Clay County, and owned by the Public Oil and Gas Company, is a Big Injun gasser, according to Gawthrop, who determined its elevation with aneroid at 885′ B. No log was obtained for this boring.

The **W. H. Evans No. 2 well—No. 196 on Map II**—located 0.7 mile southwest of the well last described and owned by the Eastern Carbon Black Company, is a million-foot gasser from the Big Injun Sand, according to Gawthrop, who determined its elevation with aneroid at 1160′ B. The Survey did not get its record.

R. P. Cogar No. 1 Well Record (No. 197 on Map II).

Union District, Clay County, on ridge, 0.7 mile northwest of Bomont; drilled by Koontz Oil & Gas Co.; authority, H. B. Davenport; completed, 1910; elevation, 1130′ B.

	Thickness. Feet.	Total. Feet.
Conductor	16	16
Sand, Upper and Lower Freeport	134	150
Coal, Upper Kittanning	6	156
Shells	34	190
Sand, Upper East Lynn and East Lynn	145	335
Coal, "No. 5 Block"	5	340
Sandy lime	55	395
Coal, Stockton and Coalburg	5	400
Sandy lime	115	515
Shells	45	560
Sand	20	580
Black slate	50	630
Lime	75	705
Slate and shells	95	800
Sandy lime	20	820
Shells	95	915
Sandy lime	20	935
Sand, Rosedale Gas	105	1040
Slate	25	1065
Lime	40	1105
Salt Sand, Rosedale (first water, 1105′; hole full at 1210′)	310	1415
Slate	15	1430
Sandy lime	130	1560
Black lime	5	1565
Red rock	15	1580
Lime	10	1590
Slate	15	1605
Lime	10	1615
Sand, Maxton	45	1660
Little Lime	30	1690
Pencil Cave	10	1700
Big Lime	130	1830
Sand, Big Injun (pay, 1857-1862′) to bottom	32	1862

10″ casing, 62′; 8″ casing, 654′ (pulled); 6⅝″ casing, 1740′; 3″ tubing, 1862′. Packed December 6; packer set 1753′; perforation, 1755′ to 1775′. Initial gas volume, 3½ million cubic feet daily from Big Injun Sand.

The **Mary Samples well—No. 198 on Map II**—located on the west bank of Porter Creek, ½ mile northwest of Bomont, in Union District, and owned by the Eastern Carbon Black Company, is a gasser, probably from the Big Injun Sand, no log of the well being obtained. Its elevation, as determined with aneroid by Gawthrop, is 805 feet above sea-level.

The **P. S. Hart No. 1 well—No. 199 on Map II**—located on north side of hill road, 0.2 mile west of the well last described, and drilled 4 to 5 years ago by the Eastern Carbon Black Company, had an initial gas volume of 3 million cubic feet daily from the Big Injun Sand, according to Gawthrop, who determined its elevation with aneroid at 965 feet above sea-level, 10 feet above an opening in the Upper Kittanning Coal bed. No log was obtained for this boring.

Samuel Stephenson No. 1 Well Record (No. 200 on Map II).

Union District, Clay County, on branch of Porter Creek, 0.8 mile northwest of Bomont; authority, United Fuel Gas Co.; completed, January 26, 1913; elevation, 1045′ B.

	Thickness. Feet.	Total. Feet.
Conductor	11	11
Sand, Lower Freeport	70	81
Lime and slate	19	100
Coal, Upper Kittanning	4	104
Sand, Upper East Lynn (hole full of water at 125′)	45	149
Slate	15	164
Sand, East Lynn	25	189
Slate	61	250
Coal, No. 5 Block	5	255
Lime and slate	40	295
Sand	20	315
Lime and slate	275	590
Sand, Salt	80	670
Slate and lime	190	860
Sand, Rosedale Gas (little gas at 865′)	20	880
Slate	20	900
Sand, Rosedale Gas	116	1016
Slate	15	1031
Sand, Rosedale Salt	334	1365
Lime	10	1375
Red rock and shells	136	1511
Sand, Maxton	55	1566
Slate	2	1568
Little Lime	28	1596
Slate	8	1604
Lime, white	8	1612
Pencil Cave	6	1618
Big Lime	129	1747
Break	8	1755
Sand, Big Injun	6	1761
Unrecorded to bottom	16	1777

Gas in top of Big Lime; oil in bottom of Big Lime at 1702′—one bailer in 24 hours. Steel-line measurements at 1625′, 1706′, 1754′ 10″, 1775′ 4″, and 1777′.

The above well, according to determinations made by Gawthrop, starts 100 feet above the horizon of the Upper Kittanning Coal, and it is a fair gasser from the top of the Big Lime, having an initial volume of 645,000 cubic feet daily and a rock pressure of 410 pounds to the square inch.

H. M. and P. S. Young No. 3 Well Record (No. 201 on Map II).

Union District, Clay County, on branch of Porter Creek, 0.9 mile northwest of Bomont; drilled by Koontz Oil & Gas Co.; authority, C. E. Krebs; completed, April 18, 1914; elevation, 1035' B.

	Thickness. Feet.	Total. Feet.
Conductor	3	3
Sand, Lower Freeport	97	100
Coal, Upper Kittanning	5	105
Sand	235	340
Coal, Stockton	5	345
Sand	55	400
Slate	20	420
Sand	90	510
Coal, Winifrede?	5	515
Slate	35	550
Sand	100	650
Slate and shells	190	840
Gas Sand, Rosedale	40	880
Slate	10	890
Salt Sand, Rosedale	550	1440
Lime	10	1450
Red rock	2	1452
Lime	13	1465
Red rock	52	1517
Sand, Maxton	48	1565
Little Lime	40	1605
Pencil Cave	2	1607
Big Lime	130	1737
Sand, Keener (gas)	30	1767
Slate	5	1772
Sand, Big Injun, to bottom	18	1790

"While drilling deeper pin broke off stem leaving stem and bit in hole, depth to top of tools 1748'. 10" casing, 20' (left in); 8¼" casing, 632' (pulled); 6⅝" casing, 1630' (left in); 3" tubing, 1748'. Water at 105', 300', 930', 1050', 1230'—filled up; trace of oil at 1630'; gas, 1739', 1747-1755'. Showed 10/10ths water through 6⅝" opening when struck."

The above well, the elevation of which was determined with aneroid by Gawthrop, starts 100 feet above the horizon of the Upper Kittanning Coal bed, and, according to the water-gauge test, it had an initial gas volume of 1,590,000 cubic feet daily from the Keener Sand.

H. M. and P. S. Young No. 1 Well Record (No. 202 on Map II).

Union District, Clay County, on ridge, 1.1 miles northwest of Bomont; drilled by Koontz Oil & Gas Co.: authority, C. E. Krebs; completed, 1911; elevation, 1165′ (?).

	Thickness. Feet.	Total. Feet.
Conductor	8	8
Red rock	8	16
Lime and shale	40	56
Sand, Upper and Lower Freeport	184	240
Coal, Upper Kittanning	5	245
Lime	5	250
Sand, Upper East Lynn and East Lynn	170	420
Slate	15	435
Lime	25	460
Coal, Stockton	7	467
Sand	30	497
Lime	23	520
Sand	50	570
Slate	5	575
Lime	5	580
Slate	20	600
Lime	15	615
Coal, Winifrede	4	619
Lime	21	640
Slate and shells	45	685
Lime	10	695
Sand	65	760
Slate and shells	175	935
Pink lime	20	955
Sand, Rosedale Gas (Nuttall?)	140	1095
Slate	10	1105
Coal, Sewell?	5	1110
Lime	15	1125
Salt Sand, Rosedale	455	1580
Black lime	10	1590
Black slate	25	1615
Hard lime	10	1625
Sand, Maxton	65	1690
Little Lime	40	1730
Pencil Cave	12	1742
Big Lime	114	1856
Sand, Keener	34	1890
Slate	6	1896
Sand, Big Injun	34	1930
Red rock, soft	10	1940
Slate and lime shells	105	2045
Lime	45	2090
Lime shells and slate	210	2300
Brown shale	25	2325
Slate and shells	295	2620
Sand, Fifth	10	2630
Lime and slate	95	2725
Sand, Bayard	10	2735
Lime, shells, and slate	265	3000

"10" casing, 56'; 8¼" casing, 695'; 5$\frac{3}{16}$" casing, 1746'; 2 bailers water, 200'; 6 bailers water, 465'; first water, 1180'; second water, 1295'; hole full of water at 1330'; wire line, 3/9—1330'; bad hole, 3/21—1520'; April 20— 1630'; bad hole, 1660'; 6½" hole, 4/25. Show little red rock, 1900'. 50/10ths water through 2", equal to 330,000 cubic feet of gas daily. 46/10ths water 2", equal to 320,000 cubic feet of gas daily."

The above well, examined by Gawthrop, starts 240 feet above the horizon of the Upper Kittanning Coal bed, and is a very light gasser in the Keener, although located nearly on the crest of the Chestnut Ridge Anticline. As in the Rosedale region of Braxton County, a coal seam—probably the **Sewell**—makes its appearance between the Rosedale Gas and Salt Sands. The log is very interesting, in that the boring penetrated to a depth of 1144 feet below the top of the Big Injun, or entirely through the sands of the Catskill Series, only what appears to be the Fifth and Bayard were encountered, and these are only 10 feet in thickness.

Gardner et al. Well Record (No. 203 on Map II).

Union District, Clay County, on east hillside of Porter Creek, 1.7 miles northwest of Bomont; well by Goshorn Oil & Gas Co.; authority, H. B. Davenport; completed, about 1912; elevation, 898' L.

	Top. Feet.	Bottom. Feet.
Big Lime	1450	1581
Sand, Keener (gas, 1591')	1581	1625
Slate	1625	1630
Sand, Big Injun (gas, 1668-1674')	1630	1680
Red rock	1680	1703
Sand, Squaw (stopped in sand)	1703	1705

"This last sand must be the Squaw or Weir Sand. As this well made some oil, it is possible they got show of oil in the top of this sand and shut down so as not to spoil the well as a gasser. Made 1,000,000 cubic feet gas in Keener; also 1,000,000 cubic feet in Big Injun."

The above well starts about 5 to 15 feet below the horizon of the Upper Kittanning Coal bed and on top of the Upper East Lynn Sandstone, according to Gawthrop.

The well, the log of which is given next below, now owned by the Public Oil and Gas Company, and examined in the field by Gawthrop, is located just west of the crest of the Chestnut Ridge Anticline and is a gasser from the Big Injun Sand. It starts about 200 feet above the horizon of the Upper

Kittanning Coal bed. **Red rock** appears at practically the base of the Conemaugh Series, or at a horizon still lower in the measures than in southwestern Braxton County, this feature in the latter region being described in Chapter V under the account of the Pittsburgh Red Shale, page 210:

H. M. and P. S. Young No. 2 Well Record (No. 204 on Map II).

Union District, Clay County, on ridge, 1.2 miles just north of west from Bomont; drilled by Koontz Oil & Gas Co.; authority, C. E. Krebs; completed, April 4, 1911; elevation, 1160' B.

	Thickness. Feet.	Total. Feet.
Conductor	13	13
Red rock and shells	32	45
Sand, Upper Freeport	115	160
Slate	10	170
Sand, Lower Freeport	70	240
Slate	15	255
Sand, Upper East Lynn	25	280
Slate	20	300
Sand, East Lynn and Homewood	130	430
Coal and black slate, Stockton	5	435
Sandy lime	15	450
Slate and shale	10	460
Sand	25	485
Coal, Coalburg	5	490
Slate	5	495
Sand	95	590
Slate and shale	125	715
Lime and sand	25	740
Slate	2	742
Gray sand	68	810
Slate and shales	70	880
Lime and sand	30	910
Slate and shells	65	975
Sand, Rosedale Gas, Nuttall?	175	1150
Coal, Sewell?	5	1155
Sand, Rosedale Salt	415	1570
Lime	10	1580
Red rock, shale, and shells	95	1675
Sand, Maxton	50	1725
Little Lime	25	1750
Slate	3	1753
Shells	3	1756
Pencil Cave	2	1758
Shells	2	1760
Pencil Cave	3	1763
White lime	7	1770
Pencil Cave	6	1776
Big Lime	119	1895
Sand, Big Injun, to bottom	25	1920

10" casing, 13-58'; 8¼" casing, 765'; 6⅝" casing, 1779'; 3" tubing, 1920'; packer set at 1813'; perforation, 1880-1900'; anchor, 105'. Little water at 590'; little water at 1080';155 bailers water at 1200'; hole full of water, 1280'.

Burdett Coal & Land Co. No. 281 Well Record (No. 205 on Map II).

Union District, Clay County, on north side of Left Fork, 1.5 miles northwest of Bomont; authority, United Fuel Gas Co.; completed, February 19, 1911; elevation, 1045' B.

	Thickness. Feet.	Total. Feet.
Soil	7	7
Sand, Lower Freeport (water)	93	100
Slate, white	30	130
Sand, Upper East Lynn	20	150
Lime, white	10	160
Slate, black	1	161
Sand, East Lynn	39	200
Slate, black	10	210
Sand, Homewood	90	300
Slate	30	330
Lime, black	10	340
Slate, black, Kanawha Black Flint?	10	350
Coal, Stockton	10	360
Slate, black	60	420
Lime, white	20	440
Slate, white	110	550
Sand	110	660
Slate, white and black	160	820
Sand, Rosedale Gas	120	940
Sand, Rosedale Salt	360	1300
Slate	5	1305
Lime	45	1350
Sand	150	1500
Sand, Maxton	75	1575
Little Lime	22	1597
Big Lime	103	1700
Sand, Big Injun (gas at 1713')	34	1734

"10" casing, 48'; 8¼" casing, 660'; 6⅝" casing, 1617'. Volume, 2,514,000 cubic feet daily. Rock pressure, 420 pounds to the square inch."

The above well, examined by Gawthrop, starts 100 to 110 feet above the horizon of the Upper Kittanning Coal and is a fine gasser from the Big Injun Sand. The former bed and the Middle Kittanning, No. 5 Block, and Coalburg Coals do not appear to be represented.

Burdett Coal & Land Co. No. 201 Well Record (No. 206 on Map II).

Union District, Clay County, on head of branch of Porter Creek, 1.4 miles northwest of Bomont; authority, United Fuel Gas Co.; completed, May 9, 1910; elevation, 1110' B.

	Thickness. Feet.	Total. Feet.
Soil	10	10
Sand	54	64
Slate	3	67
Sand	55	122
Coal, Upper Kittanning "Rider"	5	127
Lime	48	175
Sand, Upper East Lynn	75	250
Lime, black	75	325
Coal, No. 5 Block	5	330
Sand, Homewood	120	450
Slate, white	15	465
Lime	85	550
Coal, Winifrede	8	558
Sand	117	675
Lime	75	750
Slate, black	10	760
Coal, No. 2 Gas?	4	764
Sand	86	850
Slate, white	75	925
Sand, Rosedale Gas	75	1000
Coal, Sewell?	5	1005
Slate, brown	10	1015
Lime	35	1050
Sand, Rosedale Salt (water at 1100')	280	1330
Slate	20	1350
Sand	90	1440
Lime	10	1450
Red rock	20	1470
Lime	15	1485
Slate, white	62	1547
Sand, Maxton	68	1615
Slate	6	1621
Little Lime	30	1651
Pencil Cave	4	1655
Big Lime	100	1755
Sand, Big Injun (gas at 1777-1789')	45	1800
Unrecorded to bottom	1	1801

"**Minute pressure in 6⅝"**: 1st minute, 130 lbs.; 2nd minute, 200 lbs.; 3rd minute, 265 lbs.; 4th minute, 300 lbs.; 5th minute, 325 lbs.; rock pressure, 490 lbs. Volume calculated from above minute pressure, 2,654,400 cubic feet daily. Volume given with record, 1,278,000 cubic feet."

The above well, examined by Gawthrop, starts about 170 feet above the horizon of the Upper Kittanning Coal bed and is a fair gasser from the Big Injun Sand. The coal at 122 feet from the top appears to represent the **Upper Kittanning "Rider"**, a seam that is frequently exposed at outcrop in Union District, Clay County, at 30 to 40 feet above the Upper Kittanning Coal proper, the latter belonging directly above the grayish-white Upper East Lynn Sandstone, or at an interval seldom exceeding 10 feet above it.

The **J. M. Young No. 3 well—No. 207 on Map II—** located 0.3 mile northward from the well last described and about one mile down the western slope of the Chestnut Ridge Anticline and examined by Gawthrop, is a gasser from the Big Injun Sand with a capacity of two million cubic feet daily. It is owned by the Public Oil and Gas Company.

J. M. Young No. 1 Well Record (No. 208 on Map II).

Union District, Clay County, on ridge, head of Harts Branch, 1.5 miles southeast of Queen Shoals; drilled by Koontz Oil & Gas Co.; authority, H. B. Davenport and C. E. Krebs; completed, February 2, 1911; elevation, 1250′ B.

	Thickness. Feet.	Total. Feet.
Top soil	10	10
Slate, gray	90	100
Coal, Upper Freeport	5	105
Sand, Upper Freeport	45	150
Lime	20	170
Sand, Lower Freeport	105	275
Slate and shells	25	300
Coal, Upper Kittanning	5	305
Slate and shells	95	400
Sand, East Lynn	25	425
Slate	20	445
Sand, Homewood	75	520
Lime, **Kanawha Black Flint**	5	525
Coal, Stockton	5	530
Slate	20	550
Lime shells	55	605
Sand	35	640
Lime	5	645
Lime shells	65	710
Black slate	15	725
Sand	15	740
Lime	10	750
Sand	90	840
Coal, No. 2 Gas?	5	845
Lime shells	180	1025

	Thickness. Feet.	Total. Feet.
Sand, Rosedale Gas, Nuttall?	140	1165
Slate	10	1175
Lime	20	1195
Salt Sand, Rosedale	290	1485
Slate, black	13	1498
Sand	42	1540
Lime	40	1580
Red rock	5	1585
Lime	20	1605
Slate	35	1640
Lime shells	40	1680
Sand, Maxton	45	1725
Little Lime	30	1755
Sand, gray	10	1765
Slate	5	1770
Shells	3	1773
Pencil Cave	5	1778
Big Lime	111	1889
Sand, Keener (gas, 1905-1918')	29	1918
Slate	3	1921
Shale	4	1925
Slate	7	1932
Sand, Big Injun (gas, 1938-1942')	23	1955
Red rock	5	1960
Lime and sand shells	19	1979
Lime shells	43	2022
Slate and shells to bottom	138	2160

10" casing, 36'; 8¼" casing, 755'; 6⅝" casing, 1780'; 2" tubing, 2160'. 3 bailers water at 275'; 6 bailers water, 1165'; 7 bailers water, 1280'; big water, 1410'.

The above well, examined by Gawthrop, starts 300 feet above the horizon of the Upper Kittanning Coal bed, and its record includes 100 feet of the basal portion of the Conemaugh Series. According to Mr. Davenport, its initial daily gas volume was about 2 million cubic feet from both the Keener and Big Injun Sands.

Burdett Coal & Land Co. No. 203 Well Record (No. 209 on Map II).

Union District, Clay County, on north hillside of Left Fork, 1.3 miles southeast of Queen Shoals; authority, United Fuel Gas Co.; completed, March 16, 1910; elevation, 1180' B.

	Thickness. Feet.	Total. Feet.
Soil	10	10
Sand	5	15
Slate, white	65	80
Sand	355	435

	Thickness. Feet.	Total. Feet.
Broken up sand and shale	175	610
Sand	40	650
Lime and shells	142	792
Slate	122	914
Sand	84	998
Slate	2	1000
Sand, Rosedale Gas (first gas at 1000'; water at 1050')	100	1100
Sand, (hole full of water at 1300') Rosedale Salt.	480	1580
Slate, black	6	1586
Red rock	6	1592
Slate, white	6	1598
Sand, Maxton	84	1682
Little Lime	20	1702
Pencil Cave	10	1712
Lime, white	20	1732
Pencil Cave	2	1734
Sand, black	8	1742
Big Lime (second gas at 1781')	105	1847
Sand, Big Injun, to bottom	30	1877

10" casing, 80'; 8¼" casing, 822'; 6⅝" casing, 1747'. Rock pressure, 490 lbs. to the square inch. Volume, 2,251,000 cubic feet daily.

The above well, examined by Gawthrop, starts about 250 feet above the horizon of the Upper Kittanning Coal bed, and, according to the record, the only gas pays encountered occurred in the **Rosedale Gas Sand** and the **Big Lime.**

Prince Land Co. No. 608 Well Record (No. 210 on Map II).

Union District, Clay County, on north bank of Left Fork, 1.2 miles southeast of Queen Shoals; authority, United Fuel Gas Co.; completed, May 5, 1914; elevation, 885' B.

	Thickness. Feet.	Total. Feet.
Sand and shells	18	18
Sand, East Lynn	52	70
Coal, No. 5 Block	5	75
Slate	10	85
Sand, Homewood	85	170
Coal, Stockton	5	175
Slate	25	200
Lime	15	215
Slate	5	220
Coal, Coalburg	5	225
Slate and lime	30	255
Slate	15	270
Coal, Winifrede	5	275
Lime	10	285
Slate and shells	25	310
Sand, (fresh water at 315')	15	325

	Thickness. Feet.	Total. Feet.
Slate and shale	25	350
Sand	150	500
Coal, No. 2 Gas?	3	503
Slate and lime	127	630
Sand	10	640
Slate	20	660
Sand, Rosedale Gas (gas at 725')	90	750
Break	5	755
Sand	50	805
Slate	2	807
Sand, Rosedale Salt (show of oil at 817'; hole full of water at 1025-1090')	488	1295
Lime	5	1300
Red rock	6	1306
Lime	6	1312
Sand, Maxton	86	1398
Little Lime	20	1418
Pencil slate	2	1420
Shells	16	1436
Pencil slate	2	1438
Big Lime (gas show at 1525-1550')	123	1561
Sand, Keener (gas at 1573-1585')	30	1591
Slate	5	1596
Red rock	5	1601
Sand, Big Injun	19	1620
Red rock	10	1630
Slate	6	1636
Red rock	29	1665
Lime	20	1685
Sand, Squaw	15	1700
Slate	50	1750
Lime	30	1780
Slate and shells to bottom	595	2375

"Steel-line at 579', 1440' (?), 1561', 1573', and 2375'. 8¼" casing, 579'; 6⅝" casing, 1440'; 2" tubing, 1617½'. Volume, 578,000 cubic feet of gas daily."

The above well, examined by Gawthrop, starts 25 feet below the crop of the **"Queen Shoals"** or Upper Kittanning Coal bed and penetrated below the horizon of the Fifth, without finding any sands in the Catskill Series, the gas pay apparently belonging in the Keener. Owing to its proximity to Queen Shoals, its record is very important, in that it shows the true position of the No. 5 Block, Stockton, Coalburg, and Winifrede Coal beds with reference to the seam—"Queen Shoals" (Upper Kittanning)—that was once mined commercially at the latter place, the interval between the coal last mentioned and the Stockton being practically the same as exhibited in the Queen Shoals Section, pages 154-5.

The **L. D. Graham No. 2 well—No. 211 on Map II**—located in Union District on the head of Harts Branch, 0.6 mile northeast of the well last described and examined by Gawthrop, is the largest gasser yet obtained in Clay County, according to Henry B. Davenport. It was completed in December, 1907, by the Eastern Carbon Black Company, having an initial volume of about 8 million cubic feet of gas daily from the Keener and still producing in October, 1915.

No information was obtained for the **J. M. Young No. 2? well—No. 212 on Map II**—located 0.2 mile northward from that last described.

The **L. D. Graham No. 1 well—No. 213 on Map II**—located on the south bank of Harts Branch, 1.1 miles southeast of Queen Shoals, was the **first commercial gas producer** to be obtained in Clay County. According to Henry B. Davenport, it was completed by the Eastern Carbon Black Company on September 17, 1907, and had an initial volume of 1,800,000 cubic feet daily from the Keener Sand. According to Gawthrop, it starts flush with the crop of the Upper Kittanning Coal bed at an elevation of 920′ B.

The well, the record of which is given next below, starts 275 feet above the Upper Kittanning Coal bed as determined by Gawthrop. It is a good gasser from the Big Injun, with a fine showing—3 barrels natural, daily—of oil in the Rosedale "Gas" Sand, which appears to be split in two divisions. The record is very interesting, in that the three great sandstone ledges—Mahoning, Upper Freeport, and Lower Freeport—are represented in typical development for this region, as also the Upper East Lynn:

L. D. Graham No. 3 Well Record (No. 214 on Map II).

In Union District, Clay County, on ridge between Harts Branch and Left Fork, 1 mile southeast of Queen Shoals; by Eastern Carbon Black Company; authority, O. L. Davis and C. E. Krebs; completed, March 23, 1908; elevation, 1200′ B.

	Thickness. Feet.	Total. Feet.
Sand, Upper and Lower Mahoning	100	100
Slate	20	120
Sand, Upper Freeport	80	200
Slate	10	210

			Thickness. Feet.	Total. Feet.
Sand, Lower Freeport			65	275
Coal and slate, Upper Kittanning			5	280
Lime			15	295
Sand, Upper East Lynn			45	340
Slate			150	490
Coal, Stockton			5	495
Slate			25	520
Lime, black			16	536
Coal and slate, Coalburg			9	545
Shale, sandy			75	620
Sand			15	635
Slate			10	645
Lime, sandy			40	685
Slate, black			10	695
Sand			15	710
Slate			40	750
Sand (water, enough to drill with, at 800')			75	825
Shale, sandy			175	1000
Sand (gas, 1005'; show oil, 1010')	50'	**Rosedale Gas**	135	1135
Slate	25			
Sand (gas, 1090') (show oil, 3 bbls. natural daily, 1100')	60			
Break of slate			5	1140
Lime			20	1160
Sand, hard	55'	**Rosedale Salt**	345	1505
Sand, soft	75			
Slate, black	20			
Sand, hard (water, 1360'; hole full of water, 1390')	80			
Sand, soft	70			
Sand, hard	45			
Slate			10	1515
Lime, sandy			60	1575
Sand			15	1590
Slate			10	1600
Lime			5	1605
Slate, black			5	1610
Rock, red			2	1612
Lime			3	1615
Slate			30	1645
Lime			15	1660
Maxton Sand (gas at 1700'; water, 1705', enough to drill with; small show of oil, 1720')			70	1730
Little Lime			25	1755
Slate			12	1767
Lime, sandy			7	1774
Slate, pencil, black			4	1778
Big Lime			22	1800
White lime			63	1863
Lime, sandy			17	1880
Lime, white			18	1898
Big Injun Sand (good gasser, 1905-1930') to bottom			35	1933

The **Princess Coal Co. No. 1 well—No. 215 on Map II**—located on the west bank of Queen Shoals Creek, one-third mile south of Queen Shoals railway station, and completed through the Big Injun Sand by the South Penn Oil Company, was abandoned as a dry hole. It starts 10 feet above the crop of the Kanawha Black Flint ledge in typical development in the bed of the creek last mentioned. No log was obtained for this well which is just across the Clay Line in the edge of Kanawha County, but it penetrated to a depth of 2575 feet, or 1171 feet below the top of the Big Injun Sand, entirely through the Catskill Series.

The following is a record of a well, examined by Gawthrop, that starts 100 feet below the horizon of the Upper Kittanning Coal and 45 feet above the blossom of the No. 5 Block bed:

Brown, Goshorn & Swan No. 568 Well Record
(No. 217 on Map II).

Kanawha County, on east bank of Barren Creek, 1.6 miles northward from Queen Shoals; authority, United Fuel Gas Co.; completed, December 5, 1913; elevation, 695′ B.

	Thickness. Feet.	Total. Feet.
Conductor	12	12
Sand, Homewood and Upper Coalburg	118	130
Coal, Coalburg	5	135
Sand	165	300
Slate	50	350
Sand	200	550
Slate and shells	140	690
Sand, Rosedale Gas and Salt (oil and gas show at 700′)	400	1090
Red rock	90	1180
Sand, Maxton	71	1251
Little Lime	32	1283
Slate	13	1296
Pencil Cave	5	1301
Big Lime (first gas at 1409′; second gas at 1429′)	108	1409
Sand, Big Injun (third gas at 1438′)	30	1439
Red rock	54	1493

8¼″ casing, 510′; 6⅝″ casing, 1309⅛′; 2″ tubing, 1501′? Volume, 992,000 cubic feet daily from Big Injun Sand.

Wells Nos. 218 to 226 on Map II, inclusive, listed in the Clay County Table of Well Records, pages 348-349, and all located in the Queen Shoals region of Kanawha County, have been compiled from the State Geological Survey Report and Map of the latter area, prepared by C. E. Krebs and published in 1914. The reader is referred to the table last mentioned for the only information obtained concerning these wells.

Davenport et al. No. 1 Well Record (No. 227 on Map II).

Kanawha County, on Falling Rock Creek, 2.1 miles southwest of Odessa; authority, Ohio Fuel Oil Company; completed, August 6, 1914; elevation, 990' B.

	Top. Feet.	Bottom. Feet.
Coal, Middle Kittanning (967' B.)	20	23
Coal, Stockton, (834' B.)	150	156
Coal, Coalburg (782' B.)	205	208
Salt Sand	1013	1260
Maxton Sand	1460	1515
Little Lime	1515	1550
Pencil Cave	1550	1554
Big Lime	1554	1695
Big Injun Sand (gas, 1715')	1695	1718
Weir Sand (gas, 1820')	1800	1845
Total depth		2158
Drilled deeper later:		
Slate and shells to bottom	2158	2628

10" casing, 23' (left in); 8¼" casing, 480' (left in); 6⅝" casing, 1575' (left in); 2" tubing, 1759'. Plugged back to 1759'.

The above well starts 60 feet below the horizon of the Upper Kittanning Coal bed, as determined with aneroid by Gawthrop, and had an initial volume of 330,000 cubic feet of gas daily from the Big Injun and Weir Sands.

L. C. Carnes No. 1 Well Record (No. 228 on Map II).

Union District, Clay County, on head of Queen Shoals Creek, 1.2 miles west of Odessa; drilled by Koontz Oil & Gas Co.; authority, C. E. Krebs; completed, May 12, 1911; elevation, 1325' B.

	Thickness. Feet.	Total. Feet.
Slate and shells	40	40
Slate	35	75
Sand, Lower Mahoning	35	110
Slate and shells	175	285
Sand, Upper East Lynn	90	375
Slate and shells	45	420
Sand, Homewood	60	480

	Thickness. Feet.	Total. Feet
Shale and slate	50	530
Coal, Stockton	5	535
Lime	10	545
Sand, Upper Coalburg	35	580
Coal, Coalburg	2	582
Slate	33	615
Sand	40	655
Slate	50	705
Sand	40	745
Slate	35	780
Sand	15	795
Slate	60	855
Lime and sand	30	885
Slate, shells, and shale	165	1050
Sand	15	1065
Slate and shells	35	1100
Sand, Rosedale Gas	40	1140
Shale and shells	20	1160
Sand, Rosedale Gas	85	1245
Slate	5	1250
Salt Sand, Rosedale	380	1630
Lime, slate, and shells	50	1680
Sand	40	1720
Slate	5	1725
Lime and sand	25	1750
Red shale	15	1765
Slate and shells	35	1800
Red lime	20	1820
Sand, Maxton	45	1865
Little Lime	25	1890
Slate and shells	15	1905
Pencil Cave	5	1910
Hard gray limy sand	18	1928
Pencil Cave	5	1933
Big Lime	130	2063
Sand, Keener	12	2075
Break, black slate and red rock	15	2090
Pebbly sand.....15′ Red sand.....15 } **Big Injun**	30	2120
Red rock	35	2155
Sand, Squaw	10	2165
Slate and shells to bottom	153	2318

"10" casing, 61′; 8¼" casing, 940′; 6⅝" casing, 1916′; pulled out 940′; 1 bailer water at 580′; a little gas and water, 1125′; 3 bailers water, 1190′; water at 1500′; hole full of water, 1515′; a little gas at 1988′; gas, 2068′; increasing to 2075′; shows 50/10ths water in 2" opening."

The above well, examined by Gawthrop, starts 285 feet above the horizon of the Upper Kittanning Coal bed, and encountered its chief gas pay in the Keener Sand, although a little was found in the Big Lime. The water-gauge test results are equivalent to a daily volume of 330,000 cubic feet of gas.

L. C. Carnes No. 2 Well Record (No. 228A on Map II).

Union District, Clay County, just east of Carnes Knob, 0.7 mile southwest of Odessa; drilled by Koontz Oil & Gas Co.; authority, C. E. Krebs; completed, 1911; elevation, 1015' B.

	Thickness. Feet.	Total. Feet.
Slate	80	80
Sand, East Lynn	50	130
Slate	10	140
Sand	90	230
Coal, Stockton	5	235
Sand	155	390
Black slate	10	400
Sandy lime	40	440
Sand, (oil smell at 475')	70	510
Slate	15	525
Sand	75	600
Slate and shells	140	740
Sand, Rosedale Gas	50	790
Lime and shells	20	810
Sand	157	967
Black slate	3	970
Sand, Rosedale Salt	380	1350
Slate	40	1390
Sandy lime	30	1420
Sand	25	1445
Sandy lime	30	1475
Red rock	15	1490
Sandy lime	20	1510
Slate and shells	45	1555
Sand, Maxton (gas, light, at 1590')	60	1615
Little Lime	30	1645
Slate	8	1653
Sand, gray	32	1685
Big Lime	125	1810
Sand, Keener (gas at 1812')	12	1822
Red rock and slate	68	1890
Sand and lime shells	13	1903
Red rock	3	1906
Sand, Squaw, to bottom	11	1917

10" casing, 75'; 8¼" casing, 235'; 6⅝" casing, 1693'; water to drill at 40'; hole full of water at 158'; a little water at 285'.

The above well, starting almost flush with the Upper Kittanning Coal as determined from elevations obtained by Gawthrop, was abandoned as a dry hole, although gas shows were encountered in the Maxton and Keener Sands.

W. D. Carnes No. 1 Well Record (No. 229 on Map II).

Union District, Clay County, just southeast of Carnes Knob and one mile southwest of Odessa; drilled by Koontz Oil & Gas Co.; authority, C. E. Krebs; completed, 1911; elevation, 1005' L.

	Thickness. Feet.	Total. Feet.
Conductor	10	10
Sand, Upper East Lynn and East Lynn	120	130
Shells	30	160
Sand, Homewood	47	207
Coal, Stockton	3	210
Slate	70	280
Sand	95	375
Shells	25	400
Sand	50	450
Slate	40	490
Sand	85	575
Slate	210	785
Sand	155	940
Slate	5	945
Sand, Rosedale Salt (oil at 957-969') to bottom	32	977

Hole full of water at 126'; gas, 825'; gas at 955'; oil at 957-969'; water to drill, 875'.

The above well, examined by Gawthrop, starts about 15 feet below the horizon of the Upper Kittanning Coal, and encountered a small pay of oil in the **Rosedale Salt Sand,** being pumped from this horizon for 4 months after completion and then abandoned.

George King No. 1 Well Record (No. 230 on Map II).

Union District, Clay County, on branch of Porter Creek, 0.3 mile east of Odessa; drilled by Koontz Oil & Gas Co.; authority, C. E. Krebs; completed, October 4, 1912; elevation, 955' B.

	Top. Feet.	Bottom. Feet.
Coal, Stockton	200	204
Coal, Chilton?	415	420
Sand, Rosedale Gas and Salt (gas, 830'; oil, 900'; water, 1040-1210')	795	1440
Red rock	1440	1450
Red rock	1535	1540
Maxton Sand	1555	1595
Pencil Cave	1595	1600
Little Lime	1600	1622
Pencil Cave	1622	1632
Big Lime	1655	1770
Keener Sand (gas, 1776-1780')	1770	1790
Slate and red rock	1790	1802
Big Injun Sand (show oil, 1815-1830')	1802	1850

	Top. Feet.	Bottom. Feet.
Red rock	1850	1860
Gritty lime	1860	1896
Sand, Squaw (show black oil, 1900′)	1896	1907
Slate and lime shells to bottom	1907	2112

"Conductor, 16′; 10″ casing, 25′; 8″ casing, 405′; pulled 6⅝″ casing, 1600′; pulled 5$\frac{3}{16}$″ casing, 1667′. Shot July 13, 1913."

The above well, examined by Gawthrop, is a gasser from the Keener Sand and starts about 30 feet below the horizon of the Upper Kittanning Coal bed.

Porter Creek Coal & Coke Co. No. 663. Well Record (No. 231 on Map II).

Union District, Clay County, on east hillside of Porter Creek, 0.5 mile southeast of Odessa; authority, United Fuel Gas Co.; completed, December 4, 1913; elevation, 1255′ B.

	Thickness. Feet.	Total. Feet.
Clay	30	30
Sand, Upper Freeport	122	152
Slate	15	167
Sand, Lower Freeport	58	225
Coal, Upper Kittanning	2	227
Sand, Upper East Lynn and East Lynn	208	435
Slate	20	455
Sand, Homewood	45	500
Coal, Stockton	4	504
Sand	121	625
Slate	135	760
Sand	55	815
Slate and lime	225	1040
Sand 50′ Slate 7 Sand 78 } **Rosedale Gas**	135	1175
Sand, Rosedale Salt (hole full of water at 1300′)	525	1700
Red rock	58	1758
Lime	5	1763
Red rock	87	1850
Lime	15	1865
Red rock	50	1915
Slate and lime	30	1945
Little Lime	23	1968
Break	7	1975
Lime	13	1988
Pencil Cave	12	2000
Big Lime	84	2084
Sand, Keener (gas at 2097′; break at 2109-2116′)	25	2109
Sand, Big Injun	66	2175
Slate	42	2217
Sand, Squaw	20	2237
Slate and lime to bottom	248	2485

The above well, examined by Gawthrop, starts 225 feet above the Upper Kittanning Coal bed, and encountered a light pay of gas in the Keener Sand, its volume being about 190,000 cubic feet daily.

D. H. Stephenson No. 552 Well Record (No. 232 on Map II).

Union District, Clay County, on branch of Wade Fork, 1.6 miles southwest of Birch; authority, United Fuel Gas Co.; completed, May 9, 1913; elevation, 1140' B.

	Thickness. Feet.	Total. Feet.
Sand, Upper Freeport	27	27
Sand and slate	98	125
Slate	17	142
Coal, Upper Kittanning	3	145
Slate	2	147
Sand, Upper East Lynn and East Lynn	178	325
Coal, No. 5 Block	2	327
Sand, Homewood	63	390
Slate and lime	35	425
Sand	120	545
Slate and lime	65	610
Sand	80	690
Slate and lime	45	735
Coal, No. 2 Gas?	3	738
Sand	37	775
Slate and lime	185	960
Sand, Rosedale Gas and Salt	440	1400
Slate	5	1405
Sand	99	1504
Slate and lime	25	1529
Sand, Maxton	119	1648
Red rock	16	1664
Lime	35	1699
Slate and lime	88	1787
Little Lime	20	1807
Slate and shells	12	1819
Lime	8	1827
Pencil Cave	12	1839
Big Lime	109	1948
Sand, Big Injun (gas at 2013-2019')	72	2020
Red rock	12	2032
Sand, Squaw	14	2046
Shale, brown, to bottom	10	2056

10" casing, 29'; 6⅝" casing, 1640'; 5$\frac{3}{16}$" casing, 1818'; Rock pressure, 530 lbs. to the square inch.

The above well, examined by the writer, starts about 70 feet below the top of the Upper Freeport Sandstone and about 140 feet above an opening in the Upper Kittanning Coal bed. Its gas volume is reported at 1½ million cubic feet daily from the Big Injun Sand. The Middle Kittanning Coal has been cut away entirely by the coalition of the Upper East Lynn and East Lynn Sandstones.

Southeastward in the same District, on the waters of Wade Fork, the Little Sycamore Oil and Gas Company has completed during the last 3 or 4 years several fair Big Injun Sand gassers on land owned by Goshorn Heirs, the logs of which follow herewith:

Goshorn Heirs No. 5 Well Record (No. 233 on Map II).

Union District, Clay County, on east hillside of Wade Fork, 1.2 miles southwest of Shelton; authority, Little Sycamore Oil & Gas Co.; completed, 1913; elevation, 1050′ B.

	Thickness. Feet.	Total. Feet.
Unrecorded	1020	1020
Sand, Rosedale Salt	538	1558
Hard cave	7	1565
Red rock	130	1695
Lime, black	17	1712
Cave	8	1720
Little Lime	15	1735
Pencil Cave	10	1745
Big Lime	70	1815
Sand, Big Injun (gas)	125	1940
Red rock		1940
Unrecorded to bottom	888	2828

The above well, examined by the writer, starts on the bench of the Upper Kittanning Coal bed. According to W. H. Ahner, Vice-President of the Little Sycamore Oil and Gas Company, the well had an initial gas volume of one million cubic feet daily from the Big Injun Sand, the well having been shut in up to October 25, 1915, since completion, owing to lack of pipe-line facilities to market it, a feature that was expected to be remedied soon by the United Fuel Gas Company. The same is true for the other gassers completed on the Goshorn tract.

Goshorn Heirs No. 1 Well Record (No. 234 on Map II).

Union District, Clay County, on east bank of Wade Fork, 1.3 miles southwest of Shelton; authority, Little Sycamore Oil & Gas Co.; completed, 1912; elevation, 970' B.

	Top. Feet.	Bottom. Feet.
Unrecorded	0	890
Sand, Rosedale Salt	890	
Oil at 915'.		
Total depth		918

"Initial production, 10 barrels. Now, (October 26, 1915) 2 or 3 barrels, pumping."

The above well, examined by the writer, starts 75 feet below the horizon of the Upper Kittanning Coal bed, so that its oil production evidently comes from the **Rosedale Salt Sand.** This well had not been drilled below the latter sand when visited by the writer on October 26, 1915.

Goshorn Heirs No. 2 Well Record (No. 235 on Map II).

Union District, Clay County, on Wade Fork, 1.4 miles southwest of Shelton; authority, Little Sycamore Oil & Gas Co.; completed, 1913; elevation, 985' B.

	Thickness. Feet.	Total. Feet.
Unrecorded	920	920
Sand, Rosedale Gas and Salt	538	1458
Hard cave	7	1465
Red rock	130	1595
Lime, black	17	1612
Cave	8	1620
Little Lime	15	1635
Pencil Cave	10	1645
Big Lime	70	1715
Sand, Big Injun (gas), to bottom	125	1840

"Gasser in Big Injun Sand, 2,000,000 cubic feet daily. Rock pressure, 520 pounds to the square inch. On October 26, 1915, had been shut in since completion."

The above well, examined by the writer, starts 65 feet below the horizon of the Upper Kittanning Coal bed.

Goshorn Heirs No. 3 Well Record (No. 236 on Map II).

Union District, Clay County, on west bank of Wade Fork, 1.7 miles southwest of Shelton; authority Little Sycamore Oil & Gas Co.; completed, 1913; elevation, 1015′ B.

	Thickness. Feet.	Total. Feet.
Unrecorded	942	942
Sand, Rosedale Gas and Salt	538	1480
Hard cave	7	1487
Red rock	130	1617
Lime, black	17	1634
Cave	8	1642
Little Lime	15	1657
Pencil Cave	10	1667
Big Lime	70	1737
Sand, Big Injun (gas)	125	1862
Red rock at bottom		1862

"Initial gas volume, 2,000,000 cubic feet daily from Big Injun Sand; Rock pressure, 520 pounds to the square inch; shut in on October 26, 1915."

The above well, examined by the writer, starts about 50 feet below the Upper Kittanning Coal bed.

Goshorn Heirs No. 6 Well Record (No. 237 on Map II).

Union District, Clay County, in hollow, on east side of Wade Fork, 1.5 miles southwest of Shelton, and 0.3 mile east of No. 236; authority, Little Sycamore Oil & Gas Co.; completed, about 1913; elevation, 1050′ B.

	Thickness. Feet.	Total. Feet.
Unrecorded	935	935
Sand, Rosedale Gas and Salt	538	1473
Hard cave	7	1480
Red rock	130	1610
Lime, black	17	1627
Cave	8	1635
Little Lime	15	1650
Pencil Cave	10	1660
Big Lime	70	1730
Sand, Big Injun (gas)	125	1855
Red rock to bottom		1855

"Initial gas volume, 3,500,000 cubic feet daily from Big Injun Sand; Rock pressure, 520 pounds to the square inch; shut in since completion, on October 26, 1915."

The above well, examined by the writer, starts 25 feet below the Upper Kittanning Coal bed.

Goshorn Heirs No. 9 Well Record (No. 238 on Map II).

Union District, Clay County, on ridge between Wade Fork and Open Hollow, 1.5 miles southwest of Shelton; authority, Little Sycamore Oil & Gas Co.; completed, April, 1915; elevation, 1320' B.

	Thickness. Feet.	Total. Feet.
Unrecorded	425	425
Coal, No. 5 Block	5	430
Unrecorded	595	1025
Coal, Eagle?	3	1028
Unrecorded	13	1041
Slate	25	1066
Sand	24	1090
Slate	3	1093
Sand, Rosedale Gas	97	1190
Slate	5	1195
Sand, Rosedale Salt	225	1420
Slate	10	1430
Sand, Salt	220	1650
Slate	5	1655
Sand	85	1740
Red rock	65	1805
Slate	5	1810
Sand, Maxton	5	1815
Lime	30	1845
Red rock	20	1865
Lime shells	59	1924
Little Lime	25	1949
Slate and shells	28	1977
Pencil Cave	18	1995
Big Lime	119	2114
Sand, Big Injun (gas)	52	2166
Sand, red	24	2190
Unrecorded to bottom	14	2204

"Initial gas volume, 2,500,000 cubic feet daily from Big Injun Sand. Rock pressure, 520 pounds to the square inch; shut in on October 26, 1915, since completion."

The above well, examined by the writer, starts about 230 feet above the horizon of the Upper Kittanning Coal bed.

The **Goshorn Heirs No. 10 well—No. 239 on Map II**—located on ridge 0.4 mile northeast of the well last described, and completed by the same company in October, 1915, had been abandoned as a non-paying well on the 26th of the same month, although a light show of gas and a fair show of oil were encountered in the Big Injun Sand, according to W. H. Ahner, Vice-President.

Goshorn Heirs No. 11 Well Record (No. 240 on Map II).

Union District, Clay County, in Open Hollow, 1.7 miles southward from Shelton; authority, Little Sycamore Oil & Gas Co.

	Thickness. Feet.	Total. Feet.
Unrecorded	87	87
Coal, Middle Kittanning	3	90
Unrecorded	205	295
Coal, Coalburg	2	297
Unrecorded	498	795
Sand, Rosedale Gas (gas show at 890')	105	900
Slate	10	910
Sand, Rosedale Salt	548	1458
Slate	37	1495
Red rock	35	1530
Slate and lime	55	1585
Lime	25	1610
Red rock	15	1625
Slate shells	60	1685
Little Lime	45	1730
Pencil Cave	21	1751
Big Lime (gas show at 1791'; gas show and oil at 1815')	119	1870
Sand, Keener	25	1895
Break of slate	2	1897
Sand, Big Injun (oil and gas at 1923-1935')	38	1935
Unrecorded to bottom	5	1940

"Shot with 60 quarts of nitroglycerine at 1920-1935'. Small oil well from Big Injun Sand."

No elevation was obtained for the above well, but, judging from the intervals found at wells Nos. 238 and 241 on Map II, it should start 15 to 25 feet below the horizon of the Upper Kittanning Coal bed.

Goshorn Heirs No. 7 Well Record (No. 241 on Map II).

Union District, Clay County, on ridge, 1.7 miles southwest of Shelton; authority, Little Sycamore Oil & Gas Co.; elevation, 1385' B.

	Thickness. Feet.	Total. Feet.
Unrecorded	1140	1140
Sand, Rosedale Gas and Salt (gas at 1160')	660	1800
Slate	20	1820
Red rock	40	1860
Lime and slate	60	1920
Sand, Maxton	25	1945
Slate	29	1974
Little Lime	26	2000
Slate and lime	18	2018
Pencil Cave	18	2036

	Thickness. Feet.	Total. Feet.
Big Lime	114	2150
Sand, Keener	13	2163
Slate break	2	2165
Sand, Big Injun (break in slate, 2176′)	45	2210
Red rock	5	2215
Sand	20	2235
Red rock	25	2260
Slate and shells to bottom	168	2428

"Initial gas volume, 2,500,000 cubic feet daily from the Big Injun Sand. Rock pressure, 520 pounds to the square inch. On October 26, 1915, had been shut in since completion."

The above well, examined by the writer, starts about 230 feet above the Upper Kittanning Coal bed.

Goshorn Heirs No. 8 Well Record (No. 242 on Map II).

Union District, Clay County, on hill, 1.8 miles southwest of Shelton, and 0.3 mile northwest of No. 241; authority, Little Sycamore Oil & Gas Co.; elevation, 1310′ B.

	Thickness. Feet.	Total. Feet.
Soil	15	15
Sand, Upper Freeport	110	125
Slate	20	145
Sand, Lower Freeport	65	210
Coal, Upper Kittanning	5	215
Broken sand	235	450
Coal, Stockton	5	455
Slate	15	470
Coal, Coalburg (water)	5	475
Slate	50	525
Slate and shale	545	1070
Sand, Rosedale Gas (gas at 1090′)	90	1160
Slate	25	1185
Sand, Rosedale Salt	560	1745
Red rock	55	1800
Slate	20	1820
Red rock	20	1840
Lime	20	1860
Broken	35	1895
Little Lime	25	1920
Slate	15	1935
Lime	14	1949
Pencil Cave	17	1966
Big Lime	119	2085
Sand, Keener	50	2135
Red rock	5	2140
Sand, Big Injun	15	2155
Red rock to bottom	15	2170

"Initial gas volume, 1,500,000 cubic feet daily from the Big Injun Sand. Rock pressure, 520 pounds to the square inch. On October 26, 1915, had been shut in since completion."

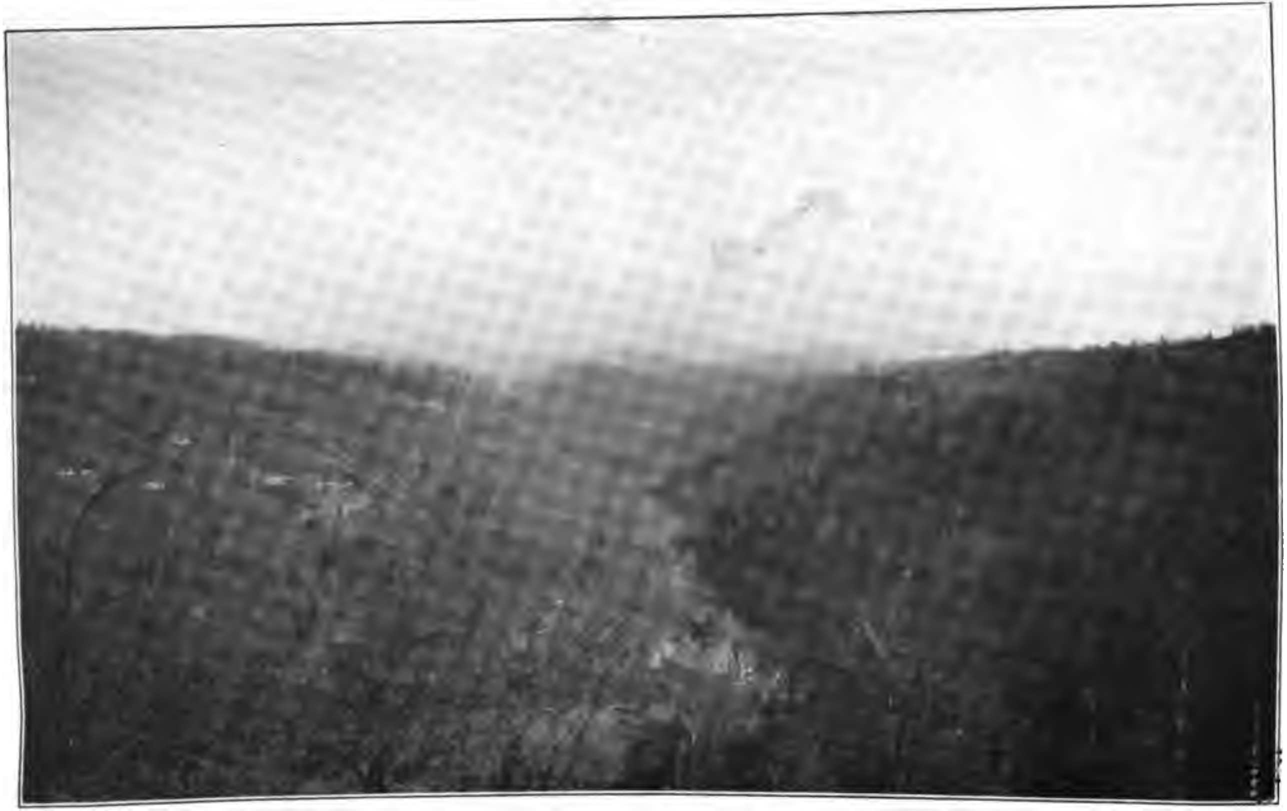

PLATE XVII.—Looking northeast up Upper King Shoals Run, Clay County; topography of Allegheny Series and Kanawha Group of Pottsville Series; upper cliff, left margin, is Upper Freeport Sandstone.

The above well, examined by the writer, starts 210 feet above the Upper Kittanning Coal bed.

The **Goshorn Heirs No. 4 well—No. 243 on Map II**—located 2.4 miles southwest of Shelton and 0.5 mile southwest of the well last described, and completed by the Little Sycamore Oil and Gas Company during 1913, was abandoned as a dry hole. No log was obtained for this boring.

Elk River Lumber Co. No. 1 Well Record (No. 244 on Map II).

Union District, Clay County, on northwest bank of Little Sycamore Creek, 0.7 mile southwest of Warfield; well by Eldorado Oil & Gas Co.; authority, H. B. Davenport; completed, September 5, 1909; elevation, 1060′ B.

	Thickness. Feet.	Total. Feet.
Sand and gravel	14	14
Sand, blue	6	20
Sand, broken	5	25
Sand, fine (10″ pipe, 49′)	25	50
Slate	15	65
Coal, Stockton	5	70
Sand (water, 70′)	15	85
Slate	10	95
Sand	10	105
Slate	5	110
Sand	40	150
Slate	25	175
Sand, broken	95	270
Lime, white	15	285
Sand	35	320
Slate, black	10	330
Sand, black	12	342
Lime	13	355
Slate, black	30	385
Coal, Cedar Grove?	2	387
Clay	13	400
Lime	15	415
Sand, broken	15	430
Slate, black	10	440
Lime	10	450
Slate	80	530
Lime, black	20	550
Sand	15	565
Lime, broken (little water, 640′)	75	640
Sand, broken	15	655
Slate	35	690
Lime, black	20	710
Slate	30	740
Sand, **Rosedale Gas** (gas, 740′)	55	795
Slate	15	810

	Thickness. Feet.	Total. Feet.
Lime, sandy	20	830
Sand, hard	40	870
Slate	40	910
Sand, hard 145′ Sand, soft (water, 1070′) 50 Rosedale Salt	195	1105
Slate	20	1125
Lime, black	35	1160
Sand, Salt (water, 1180′)	50	1210
Lime, broken	10	1220
Sand, Salt (hole full of water, 1225′)	80	1300
Lime, sandy	40	1340
Sand, loose	20	1360
Sand, hard	90	1450
Sand, loose	85	1535
Slate	5	1540
Lime	5	1545
Red shale and sand	70	1615
Lime	15	1630
Shale, sandy, Maxton	35	1665
Lime	10	1675
Slate (cave)	35	1710
Lime, broken	20	1730
Lime, hard	10	1740
Slate	5	1745
Shale, blue	10	1755
Shale, red	5	1760
Pencil Cave (set 80′, 5 3/16″ casing, 1771′)	10	1770
Lime, black 20′ Lime, white 10 Lime, white, sandy 50 Sand, Rouzer 20 Lime, brown 10 Lime, gray 25 Lime, white 10 Big Lime	145	1915
Sand, Keener	7	1922
Lime, break, black	3	1925
Sand, Big Injun (gas, 1923′; oil show, 1965′)	50	1975
Red rock	3	1978
Shale, black, to bottom	14	1992

"Details of Big Injun Sand: Sand, hard, 1925-1930′; sand, soft, 1950-1970′; gas, 1923′; oil show, 1965′. Made a flow of oil. 200,000 cubic feet of gas daily from Big Injun Sand; now, October 26, 1915, shut in. Little gas and small show of oil, 1795′. Pulled casing and reset same with 1709′ after caving. Cased with 6⅝″ at 1697′."

The above light gas well, examined by the writer, starts about 175 feet below the horizon of the Upper Kittanning Coal bed.

Blue Creek Coal & Land Co. No. 658 Well Record (No. 245 on Map II).

Union District, Clay County, at mouth of Road Fork of Blue Creek, 1.8 miles northwest of Crosby; authority, United Fuel Gas Co.; completed, April 30, 1915; elevation, 1020' B.

	Thickness. Feet.	Total. Feet.
Sand and gravel	40	40
Sand	100	140
Slate	70	210
Broken (water at 260')	50	260
Sand	135	395
Slate	25	420
Sand	60	480
Broken	40	520
Sand	85	605
Lime	65	670
Slate	30	700
Broken	175	875
Sand, Rosedale Gas	35	910
Slate and shell	50	960
Sand (water at 1000)'...140' Broken ... 35 Sand (water at 1150')....145 } **Rosedale Salt**	320	1280
Red rock cave	70	1350
Shale, slaty	10	1360
Sand	65	1425
Slate cave	5	1430
Lime, black	50	1480
Sand, Maxton	20	1500
Slate	5	1505
Lime, broken	10	1515
Red rock	10	1525
Lime shells	8	1533
Red rock	37	1570
Lime	60	1630
Broken	110	1740
Pencil Cave	10	1750
Little Lime	70	1820
Pencil? Cave	5	1825
Big Lime (small gas show at 1960')	155	1980
Sand, Keener	20	2000
Sand, Big Injun	70	2070
Slate and shells	400	2470
Sand, Berea Grit	10	2480
Slate and shells	230	2710
Sand, Gordon?	20	2730
Slate and shells	300	3030
Sand, Bayard?	11	3041
Slate and shells to bottom	135	3176

"Steel-line measurements at 105', 1200', 1626', 1873', 2470', 3140' and 3176'. 10" casing, 109'; 8¼" casing, 1210-1/6'; 6⅝" casing, 1638-5/6'; 5 3/16" casing, 1888-11/12'."

The above well, examined by Gawthrop, starts 210 to 215 feet below the horizon of the Upper Kittanning Coal bed. It had been abandoned as a dry hole in October, 1915, only a show of gas being found, this occurring in the basal portion of the Big Lime. Two sands of the Catskill Series—Gordon and Bayard—appear to be represented.

Ohio Lumber Co. No. 2 Well Record (No. 246 on Map II).

Union District, Clay County, on head of branch of Falling Rock Creek, 0.8 mile west of Glen, and 5.6 miles southeast of Queen Shoals; authority, Ohio Fuel Oil Co.; completed, April 3, 1914; elevation, 1060′ B.

	Thickness. Feet.	Total. Feet.
Soil	19	19
Lime and slate	72	91
Coal, Middle Kittanning	3	94
Sand, East Lynn	96	190
Slate and shells	285	475
Sand	40	515
Slate and shells	50	565
Sand	45	610
Slate and lime	240	850′
Sand	35	885
Slate and lime	40	925
Sand, Rosedale Salt (show of oil, 935′; hole full of water, 1200′)	390	1315
Slate	10	1325
Sand, Salt	130	1455
Slate and lime	40	1495
Sand	20	1515
Red rock	20	1535
Lime and slate	45	1580
Maxton Sand	20	1600
Red rock	70	1670
Little Lime	13	1683
Black slate	20	1703
Lime	5	1708
Pencil Cave	10	1718
Big Lime	32	1750
Break	15	1765
Big Lime	90	1855
Keener Sand (show of oil, 1857′)	25	1880
Big Injun Sand (show of oil, 1895′)	55	1935
Shale	5	1940
Broken sand, red	8	1948
Slate and red rock	62	2010
New Sand, Weir?	30	2040
Shale to bottom	186	2226

10″ casing, 18′; 8¼″ casing, 493′; 6⅝″ casing, 1725′.

The above well, examined by Gawthrop, starts about 15 feet below the horizon of the Upper Kittanning Coal bed, and was abandoned as a dry hole on completion. Shows of oil are recorded in the Rosedale Salt Sand, and the Keener and Big Injun Sands.

PROSPECTIVE OIL AND GAS AREAS IN UNION DISTRICT, CLAY COUNTY.

A careful study of the foregoing records and the structural conditions associated with the wells in question leads to the conclusion that there still remains a large acreage in Union District on which the prospects appear reasonably good to obtain gas or oil in paying quantities. (1) That region lying along the crest of the Chestnut Ridge Anticline, 1 to 2 miles down the west slope of the latter fold northeastward from Porter Creek to the common corner of Clay, Kanawha, and Roane Counties, is favored both by structure and present development for gas in the Keener and Big Injun Sands, as also that, lying on the drainage basin of Queen Shoals Creek above the mouth of Barker Hollow. (2) For the same reason, that, lying westward from the summit of the east hillside of Porter Creek between the 1000- and the 1075-foot contours of the Upper Kittanning Coal to the Clay-Kanawha Line, appears favorable for gas in the same sands, as also that, included in the drainage of the west side tributaries of Little Sycamore Creek above the mouth of Open Hollow. (3) That, lying southward from Upper Birch Run to Wade Fork, for similar reasons, is favored for gas in the Keener and Big Injun, with a chance for oil in the Rosedale Salt Sand northeastward from well No. 234 on Map II along the valley of the latter stream. (4) As the lay of the Upper Kittanning Coal conforms fairly well with that of the Rosedale Salt Sand in that region lying along the line joining **Wells Nos. 229 and 234 on Map II,** there is a probability of the oil pool encountered in the sands last mentioned in each of the latter wells joining along this line. A test well located on Porter Creek, ¾ mile southward from Odessa, would not only be favored for oil at this horizon, but also for gas in the Keener and Big Injun. (5) The Big Injun Sand oil pool of Union District appears to be defined by present development on the west and immediate south, and only fairly so on the east by the dry hole at Well No. 144 on Map II and the very light pay obtained at Nos. 154 and 157. There is a possibility that this pool may have a southeast extension closely along a line from No. 181 to No. 239, in view of the Big Injun oil showing found in the latter well. A test located on Wade Fork, just above the mouth of Lick Run, would offer the additional chance for oil in the Rosedale Salt Sand. The northward extension of this pool is problematical, but in the writer's judgment, there is a strong probability that it may extend northward closely along each side of the axis of the Grassland Syncline, as the latter is outlined on Map II, to the Union-Henry District Line, and possibly beyond the latter in **Henry District** to Barton and beyond to near the 700-foot contour of the Upper Kittanning Coal. A test well along Elk River, ½ mile southwest of Marne; another, on Horner Fork of Laurel; and a third, near Barton, should determine the matter.

CHAPTER X.

COAL.

In Chapters V to VIII, inclusive, a brief description has been given of all the coal seams observed in the two counties, along with a more complete account of the thin and unimportant beds, including many special sections. In this Chapter numerous special sections obtained at crop exposures, country banks, prospect openings, and commercial mines will be given for those beds which appear to have attained minable dimensions, purity, and regularity, along with etchings showing their approximate minable area. At the end of the Chapter, there is a table of analyses, giving the chemical composition, calorific value, and fuel ratio of all the coals tested.

STATISTICS OF COAL PRODUCTION.

Coal mining operations on a commercial basis have been insignificant in Braxton and Clay compared to some of the other counties in West Virginia, the records of production showing them near the bottom in point of output in tons. In the former county, only the Pittsburgh bed has been mined commercially; while in the latter, only the Upper Kittanning and Coalburg have been operated. All the mines are driven directly on the crop, since there is not a single shaft operation in the territory of this Report.

The following table is compiled from the Annual Report of Earl A. Henry, Chief of the Department of Mines of West Virginia, for the year ending June 30, 1915:

Coal Production of Braxton and Clay Counties for the Years Ending June 30, 1904 to 1915, Inclusive.

Year	Braxton County	Tons of 2240 lbs.	Year	Clay County	Tons of 2240 lbs.
			1904	....	2,860
			1905	....	60,455
			1906	....	66,087
1907	....	55,774	1907	....	60,252
1908	....	91,763	1908	....	42,461
1909	....	93,024	1909	....	25,797
1910	....	114,422	1910	....	36,306
1911	....	175,846	1911	....	92,205
1912	....	203,430	1912	....	181,963
1913	....	233,712	1913	....	266,388
1914	....	265,101	1914	....	396,411
1915	....	294,206	1915	....	531,645
	Total	1,527,278		Total	1,762,830
Total for both Counties					3,290,108

According to data published in the same Report, Braxton, in the **order of the production of coal by counties,** ranked 26th in 1907, 23rd in 1908-1911, inclusive, 22nd in 1912, and 23rd in 1913, 1914, and 1915; while Clay ranked 25th in 1904, 23rd in 1905-6, 24th in 1907, 27th in 1908, 30th in 1909 and 1910, 25th in 1911, 24th in 1912, 22nd in 1913 and 1914, and 20th in 1915.

Production of Coal by Mines in Braxton and Clay Counties for the Year Ending June 30th, 1915.

Name of Company	Name of Mine	Production of Coal. Tons of 2240 Lbs.			Distribution of Coal. Tons of 2240 Lbs.		
		First Six Months.	Second Six Months.	Total Coal Produced during Year.	Used in Operation of Mine.	Furnished Local Trade and Tenants.	Quantity Shipped from Mines.
Braxton County:							
Copen Creek Coal Co.	Vanwith	25,000	25,000	50,000	....	250	49,750
Davis Colliery Co.	Bower Nos. 10, 3, 7	95,322	83,930	179,252	3,084	637	175,531
Davis Colliery Co.	Copen No. 11	37,312	27,642	64,954	22	464	64,468
Totals (Braxton)		157,634	136,572	294,206	3,106	1,351	289,749
Clay County:							
Elk River Coal & Lumber Co.	Rich Run	211,280	224,632	435,912	4,308	1,507	430,097
Elliott Splint Coal Co.	York No. 1	44,173	23,006	67,179	1,072	714	65,393
Queen Shoals Coal Co.	Burnzwell	11,989	16,565	28,554	266	734	27,554
Totals (Clay)		267,442	264,203	531,645	5,646	2,955	523,044
Grand Totals for both Counties		425,076	400,775	825,851	8,752	4,306	812,793

All the mines in each county are located along the Coal and Coke Railway with the exception of that owned by the Elk River Coal and Lumber Company, which is near the eastern terminus of the Buffalo Creek and Gauley Railroad, the latter connecting with the former railway at Dundon, Clay County.

In the territory of this Report, there are 15 minable beds of coal, in addition to 22 others that are too thin, impure, and irregular to be of much economic importance. These minable coals in descending order are the **Pittsburgh** of the Monongahela Series; **Bakerstown** of the Conemaugh; **Upper Freeport, Lower Freeport, Upper Kittanning, Middle Kittanning, Lower Kittanning (No. 5 Block)** and **Little No. 5 Block—Clarion** of the Allegheny; **Stockton, Coalburg, Winifrede, Marpleton (Cedar Grove?), Campbell Creek (No. 2 Gas)** and **Eagle** of the Kanawha Group of the Pottsville; and the **Sewell** of the New River Group of the latter Series. Figure 3 shows the relative position in descending order of all the coals observed in the area, the minable beds being represented by the heavily shaded lines and the intervals between them expressed in feet. Figures 4 to 15, inclusive, published on subsequent pages of this Chapter, show the approximate minable areas of the beds that appear to attain commercial importance, subject to the limitations defined in the Author's Preface.

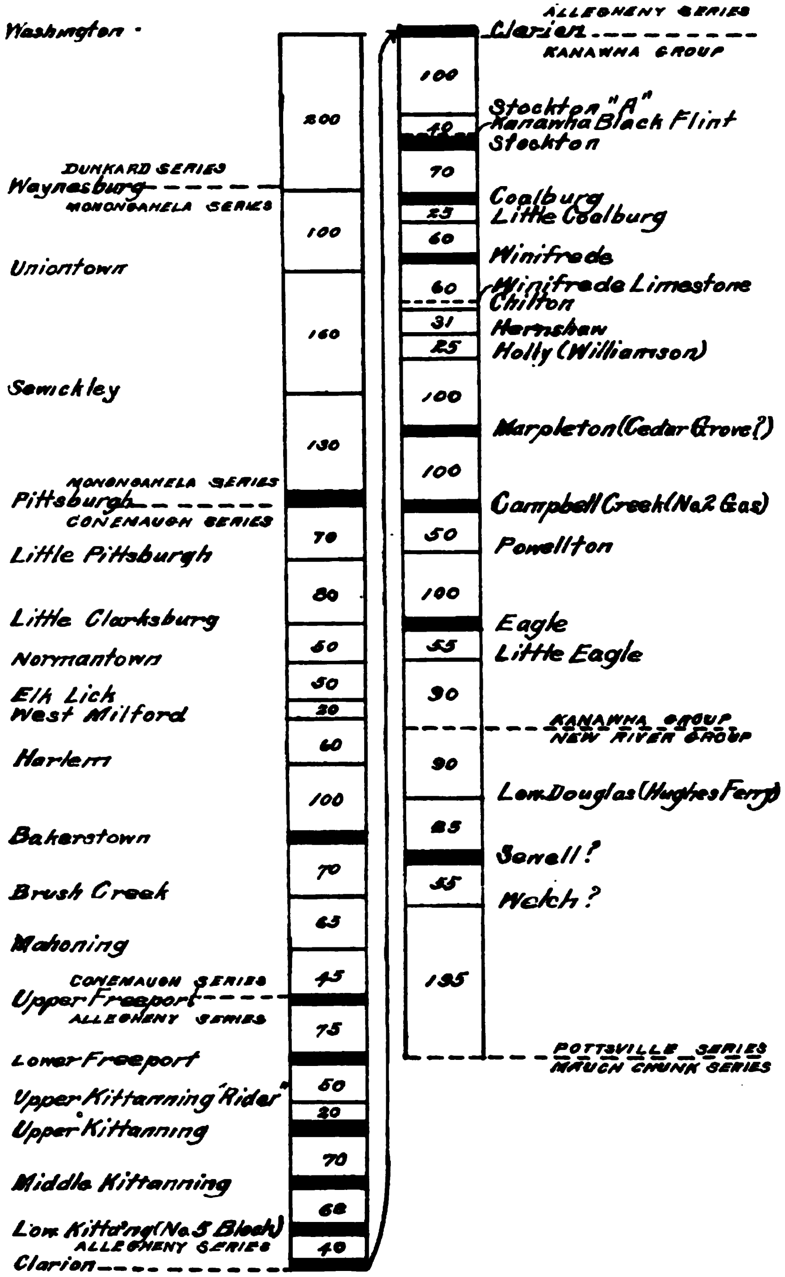

FIGURE 3.—Showing intervals in feet between Coal Seams of the Braxton-Clay Area—in the Dunkard, Monongahela, Conemaugh, Allegheny and Pottsville Series.

RECORDS OF COAL TEST BORINGS IN BRAXTON COUNTY.

SUMMARIZED RECORDS.

In Braxton County, 20 borings have been sunk to test for coal and 5 for water—fresh and salt. The detailed logs of only a few of these were secured, as most of the operators failed to honor requests of the Survey for these data. The following table gives a complete list of all such borings within the county, in addition to 16 others in the adjoining portions of Lewis, Gilmer, and Nicholas. While the table lacks many

Summarized Record of Coal Test and

No on Map II.	NAME OF PROPERTY	MAGISTERIAL DISTRICT	COMPANY	Elevation Above Sea-Level
1	Daniel U. O'Brien No. 1	(Gilmer Co.)	N. T. Arnold	1048B
2	H. A. Pool	Salt Lick	Cosmopolitan C. & C. Co.	1020B
3	S. J. Singleton No. 1	Salt Lick	(?)	1090B
4	S. J. Singleton No. 2	Salt Lick	(?)	1290B
5	Chas. Singleton No. 1	Salt Lick	Cosmopolitan C. & C. Co.	960B
6	J. T. Berry No. 1	Salt Lick	Cosmopolitan C. & C. Co.	895B
7	John P. Berry water well	Salt Lick	John P. Berry	1010B
8	M. Rose water well	Salt Lick	......	864L
9	Geo. Hammer No. 1	Salt Lick	Davis & Elkins	890B
10	W. H. H. Galford No. 1	Salt Lick	Davis & Elkins	930B
11	Salt water well	Salt Lick	W. P. Haymond	800B
12	Addison McLaughlin salt well	Salt Lick	John Haymond	770B
13	W. E. Mick No. 1	(Lewis Co.)	S. B. Elkins	1110B
14	T. M. Marshall No. 1(?)	(Gilmer Co.)	Lit. Kanawha Syndicate.	845B
14A	Geo. L. Smith No. 1	(Gilmer Co.)	Lit. Kanawha Syndicate.	975B
15	T. M. Marshall No. 1	(Gilmer Co.)	T. M. Marshall	845B
16	C. E. Marshall No. 2	(Gilmer Co.)	Withers & Vandevender.	830B
17	C. E. Marshall No. 1	(Gilmer Co.)	Withers & Vandevender.	810B
18	T. M. Marshall No. 2(?)	(Gilmer Co.)	E. D. Fulton	725L
19	G. A. Sponangle No. 2	(Gilmer Co.)	E. D. Fulton	1115B
20	G. A. Sponangle No. 1	(Gilmer Co.)	E. D. Fulton	885B
21	Clara Moore No. 1	(Gilmer Co.)	Lit. Kanawha Syndicate.	970B
22	D. A. Clowser No. 1	(Gilmer Co.)	E. D. Fulton	950B
23	W. A. Reed No. 1	(Gilmer Co.)	Lit. Kanawha Syndicate.	1025B
24	J. B. Spicer No. 1	Otter	Chas. Despard	950B
24A	I. O. Moyers	Otter	Chas. Despard	940B
24B	W. W. Wilson	Otter	Chas. Despard	935B
25	Matthias Gerwig No. 1	Otter	Lit. Kanawha Syndicate.	1065B
26	W. F. Morrison core test	Otter	Morris Cohen	......
27	Jasper Nelson water well	Otter	Jasper Nelson	1400B
28	Philip A. Gibson water well	Otter	Philip A. Gibson	1475B
29	T. B. Frame core test	Birch	Stone & Felty	935B
30	J. C. Dean core test	Birch	W. F. Duffield	801L
31	Jasper Given core test	Birch	Morris Cohen (?)	825B
32	W. F. Duffield core test	Birch	W. F. Duffield	970B
33	Perkins core test	(Nicholas Co.)	J. A. Emmart	1200B
34	Perry Wilson core test	(Nicholas Co.)	B. W. Perkins	1245B
35	Enterprise Coal Co. core test	(Nicholas Co.)	Enterprise Coal Co	1105B
36	Adaline Crantz core test	(Nicholas Co.)	Enterprise Coal Co	1235B
37	G. H. Ocheltree water well	Holly	Jas. Cutlip	850B
38	Barley Fisher core test	Holly	......	1115B

details which the complete logs would have afforded, yet it gives much information of value, the columnar headings of which explain themselves. Elevations, depths, and thicknesses are expressed in **feet.** The first and last columns give the serial number designating the boring on Map II and this is always given in the text when the well is mentioned. All the borings were visited in the field, and the horizon of their well mouths determined as near as possible. Under the elevation column, the letter "B" indicates barometric measurements checked on the nearest U. S. Geological Survey elevation; and the letter "L", a spirit-level determination:

Other Borings in Braxton County.

PITTSBURGH COAL		UPPER FREEPORT COAL		UPPER KITTANNING COAL		MIDDLE KITTANNING COAL		NO. 5 BLOCK-LOWER KITTANNING COAL		Total Depth	No. on Map II
Depth Top	Thickness.	Depth Top	Thickness	Depth Top	Thickness	Depth Top	Thickness	Depth Top	Thickness		
......	......	......	......	......	......	......	......	......	......	265	1
......	......	......	......	......	......	......	......	......	......	——	2
......	......	......	......	......	......	......	......	......	......	——	3
......	......	......	......	......	......	......	......	......	......	——	4
......	......	......	......	......	......	......	......	......	......	563	5
......	......	280.9	0.2	417.7	5.6	——	——	449.5	8.5	578	6
......	......	......	......	......	......	......	......	......	......	150	7
......	......	20	11(?)	......	......	......	......	......	......	31	8
......	......	......	......	......	......	......	......	......	......	(300)	9
......	......	55	——	......	......	......	......	......	......	(375)	10
......	......	......	......	......	......	......	......	60	9	69	11
......	......	......	......	......	......	......	......	......	......	——	12
......	......	......	......	......	......	......	......	......	......	——	13
......	......	......	......	......	......	......	......	......	......	——	14
......	......	......	......	......	......	......	......	......	......	——	14A
74	6	......	......	......	......	......	......	......	......	114	15
......	......	......	......	......	......	......	......	......	......	——	16
......	......	......	......	......	......	......	......	......	......	——	17
112	7.7	......	......	......	......	......	......	......	......	——	18
......	......	......	......	......	......	......	......	......	......	——	19
......	......	......	......	......	......	......	......	......	......	——	20
......	......	......	......	......	......	......	......	......	......	——	21
......	......	......	......	......	......	......	......	......	......	——	22
......	......	......	......	......	......	......	......	......	......	——	23
......	......	......	......	......	......	......	......	......	......	(65)	24
......	......	......	......	......	......	......	......	......	......	(52)	24A
(60)	(1)	......	......	......	......	......	......	......	......	(160)	24B
......	......	......	......	......	......	......	......	......	......	——	25
......	......	......	......	......	......	......	......	......	......	106.8	26
......	......	......	......	......	......	......	......	......	......	195	27
......	......	......	......	......	......	......	......	......	......	106	28
......	......	......	......	......	......	......	......	......	......	(220)	29
......	......	......	......	89.3	3.2	173.3	8.7	214.7	4.2	231	30
......	......	......	......	......	......	......	......	......	......	——	31
......	......	......	......	148.4	1.9	224.9	0	261.9	4.1	285.3	32
......	......	......	......	......	......	......	......	......	......	297.3	33
......	......	......	......	......	......	......	......	......	......	202.9	34
......	......	......	......	......	......	......	......	......	......	——	35
......	......	......	......	......	......	......	......	......	......	——	36
......	......	......	......	47	4	......	......	......	......	51	37
......	......	......	......	......	......	13	1.3	27.7	13.8	252	38

DETAILED COAL TEST BORING RECORDS, SALT LICK DISTRICT.

In Salt Lick District, Braxton County, 8 borings have been listed that were sunk to test for coal; 2, for salt water; and 2, for fresh water, all of which are designated by Nos. 2 to 13, inclusive, on Map II, and in the accompanying table, the latter showing the only information obtained for Nos. 2, 3, 4, 9, 10, and 12.

The diamond drill boring, the log of which is given next below, starts about 165 feet below the horizon of the Pittsburgh Coal bed, as determined by Gawthrop. Its log is interesting, in that **red shales** are shown immediately overlying the Upper Mahoning Sandstone, a feature that is prominent at outcrop in southwestern Braxton and in Clay County:

Chas. Singleton Coal Test Boring No. 1 (No. 5 on Map II).

In Salt Lick District, on head of Burns Run, 1.6 miles N. 75° W. of Rollyson; authority, D. D. Van Swearingen, Uniontown, Pa.; completed, June 25, 1910; elevation, 960′ B.

	Thickness. Feet.	Total. Feet.
Red shale	33	33
Green, red and mixed shales	104	137
Gray sandstone, **Grafton**	40	177
Green sandy shale	30	207
Mixed shales	13	220
Red shale, **Pittsburgh**	47	267
Green sandy shale	18	285
Red shale	8	293
Green sandy shale	12	305
Red and green sandy shale	20	325
Gray sandstone, very hard, **Buffalo**	15	340
Green sand shale	30	370
Green and **red shales**	31½	401½
Sandstone, **Upper Mahoning**	14	415½
Gray sand shale	10⅝	426
Dark shale	10	436
Green shale	10	446
Dark sand shale	24	470
Gray sandstone, **Upper Freeport**	15	485
Dark-green shale	38	523
Gray sandstone, very hard, **Lower Freeport**	40	563

The diamond drill boring, the log of which is given next below, starts about 350 feet below the horizon of the Pittsburgh Coal bed, as determined by Gawthrop. Its log is very interesting, in that details are given of the entire Allegheny

Series, as also the basal portion of the Conemaugh and the top of the Pottsville:

J. T. Berry Coal Test Boring No. 1 (No. 6 on Map II).

In Salt Lick District, on a west branch of O'Brien Fork, 0.5 mile southwest of Rollyson; authority, D. D. Van Swearingen; completed, February 27, 1910; elevation, 895' B.

		Thickness. Ft.	In.	Total. Ft.	In.		
Surface		12	0	12	0		
Sandstone		10	0	22	0		
Green sandy and gray shale		24	0	46	0		
Red shale		25	0	71	0		
Sand shale		8	0	79	0		
Mixed shale		29	0	108	0		
Sandstone ....11' 0"							
Mixed shale.........18 0	Buffalo.	76	0	184	0		
Sand shale..........19 0							
Gray sandstone.....28 0							
Black slate, Brush Creek		6	0	190	0		
Coal, (Brush Creek)		0	6	190	6	190'	6"
Fire clay		0	6	191	0		
Dark slate		6	0	197	0		
Sandstone, Upper Mahoning		27	0	224	0		
Gray shale		6	0	230	0		
Dark shale, Mahoning Coal horizon at top		14	0	244	0		
Gray sandstone		2	0	246	0		
Gray sandy shale		30	0	276	0		
Dark slate, Uffington Shale		4	10	280	10	90'	4"
Coal, (Upper Freeport)		0	2	281	0		
Slate		1	0	282	0		
Sandy slate		10	0	292	0		
Sandstone		2	0	294	0		
Black slate		8	0	302	0		
Gray sandstone, (Upper Freeport)		36	0	338	0		
Black slate		1	0	339	0		
Bone coal...........0' 6"							
Coal 0 5							
Bone slate..........1 0	Lower Freeport	5	0	344	0	63'	2"
Coal 3 1							
Dark shale		33	0	377	0		
Gray sandstone, Lower Freeport		21	0	398	0		
Bone coal, Upper Kittanning "Rider"		0	3	398	3		
Fire clay		1	0	399	3		
Sandstone, shale partings		18	0	417	3		
Black slate		0	5	417	8		
Coal ....2' 10"							
Fire clay and slate 1 0	Upper Kittanning.	5	7	423	3	79'	3"
Coal 1 9							
Fire clay		4	0	427	3		
Black slate		1	3	428	6		
Dark sand shale		19	0	447	6		

		Thickness.		Total.			
		Ft.	In.	Ft.	In.		
Fire clay		2	0	449	6		
Coal ....1′ 4″ Black slate....0 2 Coal ....0 6 Mixed shale....3 0 Bone coal....1 0 Clean coal....2 6	Lower Kittanning	8	6	458	0	34′	9″
Limestone		4	0	462	0	4′	0″
Gray sandstone, Homewood		85	0	547	0		
Coal, Stockton "A"		1	0	548	0	86′	0″
Black slate		1	0	549	0		
Sand shale to bottom		29	0	578	0	30′	0″

The **John P. Berry water well—No. 7 on Map II**—located in the southern edge of Salt Lick District, 1 mile due east of Berry Siding and examined by the writer, encountered 8 inches of coal at a depth of 99 feet, and 7 feet of coal at 143 feet, according to Mr. Berry. It starts at an elevation of 1010′ B., apparently on the bench of the Elk Lick Coal, so that the first bed encountered evidently correlates with the Harlem, and the second, with the Bakerstown. The boring was sunk with a churn drill, thus making the thickness reported for the latter unreliable.

The **M. Rose water well—No. 8 on Map II**—located on the west bank of Saltlick Creek, 0.3 mile southeast of Corley, at an elevation of 864′ L., determined by the writer, encountered 11 feet of coal and slate mixed, at a depth of 20 feet, according to Albert Rose. This bed should correlate with the Upper Freeport Coal.

As mentioned above, the logs of **Coal Test Borings Nos. 9 and 10 on Map II**, located on Tom Hughes Fork and Spruce Fork, 0.9 mile southeast of Corley and 1.1 miles northeast of Corley, respectively, and completed 13 to 14 years ago by the Davis and Elkins' interests, could not be obtained. Their elevation is given in the table of boring records for Braxton, from which, in conjunction with the Upper Kittanning Coal contours on Map II, the horizon of their well mouths may be approximately determined. In No. 10, a coal bed was encountered at a depth of 55 feet, according to a native, which, if true, should correlate with the **Upper Freeport bed.**

The **salt-water** borings—**Nos. 11 and 12 on Map II**—located at Falls Mill and Bulltown, respectively, were drilled shortly before the Civil War for the purpose of obtaining brine for the manufacture of salt. No information as to the strata penetrated was obtained for the latter, but, according to William Johnson of Falls Mill, 9 feet of coal was encountered in the former boring at a depth of 60 feet. This should correlate with the No. 5 Block bed, since the Upper Kittanning outcrops 40 to 50 feet above the well mouth. (See Falls Mill Section, page 55).

COAL TEST WELL RECORDS IN OTTER DISTRICT, BRAXTON COUNTY.

In Otter District, 7 borings have been listed in the table for Braxton County, 5 of which were sunk to test for coal and 2, to obtain fresh water for domestic use. The Survey was unable to obtain the logs of **Coal Test Borings Nos. 24, 24A, and 24B on Map II,** on Walker Fork, 1 mile eastward from Waldeck, in the northwest edge of the District. These were visited in the field by Gawthrop and the only information obtained concerning them is given under their corresponding serial numbers in the table above mentioned. According to data given Gawthrop by natives, 1 foot of coal was encountered in No. 24B at a depth of 60 feet, which, if true, should correlate with the Pittsburgh bed.

The **Matthias Gerwig Coal Test Boring—No. 25 on Map II**—located in the northwest edge of Otter District on the head of Toms Fork, 0.2 mile southwest of Hope and examined in the field by Gawthrop, was drilled by the Little Kanawha Syndicate and starts about 140 feet above the horizon of the Pittsburgh Coal bed. Its record could not be obtained.

The diamond drill boring, the log of which is given next below, starts 30 to 40 feet below the horizon of the Upper Freeport Coal bed and its record reveals the absence of coal in the 106.8 feet of measures penetrated, the details of which were kindly furnished the Survey by W. F. Duffield of Sutton, Braxton County:

W. F. Morrison Coal Test Boring (No. 26 on Map II).

In Otter District, on south bank of Elk River, 200 yards southwest of the mouth of Coon Creek; by Morris Cohen; completed, August 18, 1906; elevation, about 815′ B.

	Thickness. Feet.	Total. Feet.
Surface	23.2	23.2
Sandstone 6.8′ Sandstone 12.0 } Upper Freeport	18.8	42.0
Sand shale	21.0	63.0
Sandstone, Lower Freeport	20.0	83.0
Slate, dark	3.0	86.0
Sand shale to bottom	20.8	106.8

The **Jasper Nelson water well—No. 27 on Map II**—located on the Otter-Birch District Line, ¾ mile S. 70° W. of the summit of Coon Knob, and examined by the writer, starts at an elevation of 1400′ B., about 250 feet below the Pittsburgh Coal, and penetrated to a depth of 195 feet without finding any coal, according to Mr. Nelson, although the horizon of the bed at **Coal Opening No. 17 on Map II**, 0.33 mile southward, should have been found at a depth of about 90 feet.

The **Philip A. Gibson water well—No. 28 on Map II**—located at the road fork, 1.33 miles eastward from the summit of Coon Knob, and examined by the writer, starts at an elevation of 1475′ B., about 200 feet below the Pittsburgh Coal bed, penetrated to a depth of 106 feet, and encountered a blossom of **Elk Lick Coal** at a depth of 60 feet, according to the owners of the well.

DETAILED COAL TEST BORING RECORDS, BIRCH DISTRICT, BRAXTON.

In Birch District, only 4 coal test borings have been listed in the table for Braxton County; viz, Nos. 29 to 32, inclusive, on Map II. The **T. B. Frame Core Test Boring—No. 29 on Map II**—located on the head of Laurel Run of Duck Creek, 1.9 miles northwest of Villa Nova, and drilled 10 to 12 years ago by Stone and Felty of Connellsville, Pennsylvania, starts at an elevation of about 935′ B., or about 435 feet below the horizon of the Pittsburgh Coal and about 200 feet above that of the Upper Freeport bed. The Survey was unable to obtain the log of this boring, but, according to Draper M. Duffield, a native residing on the head of O'Brien Creek, it penetrated to a depth of 200 to 240 feet without finding any coal and it was supposed to have gone through the horizon of the "O'Brien Creek" or Upper Kittanning bed. Even if the latter figure was attained, it still lacked about 100 feet of reaching down to the latter seam.

The detailed log of the **J. C. Dean Core Test Boring—No. 30 on Map II**—located on the east bank of Canoe Run opposite Glendon, and the horizon of its well-mouth determined by the writer, is published in Chapter IV, in connection with the Glendon Section, pages 86-7.

The Survey was unable to obtain the log of the **Jasper Given Coal Test Boring—No. 31 on Map II**—located on the north bank of Leatherwood Run, 1.1 miles due east of Glendon and one-eighth mile up from Birch River, its elevation being determined by Gawthrop at 825′ B., about 70 feet above the horizon of the Upper Kittanning Coal bed.

The detailed log of the **W. F. Duffield Core Test Boring—No. 32 on Map II**—located on the south bank of Diatter Run, and the horizon of its well-mouth determined by the writer, is published in Chapter IV in connection with the Twistville-Diatter Run Section, pages 83-4.

The two following records are from borings located just across the line from Birch District in the edge of Nicholas County:

Perkins Core Test Boring Record—No. 33 on Map II.

In northwest edge of Nicholas County, on head of Right Fork, 0.8 mile N. 75°-80° E. of common corner of Braxton, Clay and Nicholas Counties; by J. A. Emmart; authority, C. E. Krebs; completed in 1913; elevation, 1200′ B.

	Thickness.		Total.	
	Ft.	In.	Ft.	In.
Surface (probably holds No. 5 Block Coal)	27	0	27	0
Shale	4	5	31	5
Sandstone	23	4	54	9
Sandy shale	10	3	65	0
Slate	1	0	66	0
Fire clay, Clarion?	10	1	76	1
Slate	0	2	76	3
Sandstone	1	1	77	4
Sandy shale	1	6	78	10

				Thickness. Ft.	In.	Total. Ft.	In.		
Black slate				1	9	80	7	80'	7"
Sandstone, Homewood				43	8	124	3		
Sandstone full of shale streaks				2	5	126	8		
Sandstone				0	6	127	2		
Laminated coal and bone	1'	11"	Stockton	3	11	131	1	50'	6"
Fire clay	0	5							
Laminated coal and bone	0	7							
Coal	0	3							
Laminated coal and bone	0	9							
Sandstone, Upper Coalburg, with coal streaks				53	9	184	10		
Shale, sandstone streaks				0	10	185	8		
Sandstone				6	7	192	3		
Dark sandstone, shale streaks				1	5	193	8		
Sandstone	25'	2"	Upper Winifrede	43	0	236	8		
Sandstone, coal streaks	17	10							
Fire clay, coal streaks				1	0	237	8		
Coal	0'	3"	Winifrede	5	8	243	4	112'	3"
Sandstone	0	6							
Fire clay, sandstone streaks	1	8							
Sandstone, coal streaks	1	7							
Coal	0	6							
Black slate with laminated coal	0	6							
Coal	0	5							
Coal and bone	0	3							
Dark sandy shale				1	1	244	5		
Sandstone, coal streaks				10	0	254	5		
Sandy shale				2	4	256	9		
Black slate				1	0	257	9		
Fire clay				1	0	258	9		
Sandy shale				1	4	260	1		
Sandstone				4	0	264	1		
Shale with sandstone streaks				24	8	288	9		
Coal	0'	5"	Chilton	1	4	290	1	46'	9"
Fire clay	0	2							
Coal	0	1							
Bone	0	1							
Coal	0	5							
Bone	0	2							
Fire clay				2	2	292	3		
Sandstone to bottom				5	0	297	3	7'	2"

The above boring, examined by Gawthrop, starts about 100 feet below the horizon of the Upper Kittanning Coal bed.

Perry Wilson Coal Test Boring—No. 34 on Map II.

In Nicholas County, on Right Fork, 0.4 mile southeastward from boring last given; by B. W. Perkins; authority, C. E. Krebs; completed in 1913; elevation, 1245' B.

	Thickness.		Total.	
	Ft.	In.	Ft.	In.
Surface	21	0	21	0
Sandstone	1	9	22	9
Dark slate and wash, No. 5 Block Coal horizon?	3	9	26	6
Fire clay, Lower Kittanning	2	11	29	5
Sandstone, gray. 64' 11" }				
Dark sandstone..20 8 } Homewood	94	9	124	2
Light sandstone. 9 2 }				
Coal, Stockton "A"	0	9	124	11
Sandstone	10	3	135	2
Sandstone, with coal streaks, Stockton	14	6	149	8
Shale	1	1	150	9
Sandstone, with coal streaks	31	3	182	0
Sandstone, with shale streaks	11	11	193	11
Sandy shale to bottom	8	11	202	10

The above boring, examined by Gawthrop, starts about 80 feet below the horizon of the Upper Kittanning Coal bed.

DETAILED COAL TEST BORING RECORD, HOLLY DISTRICT, BRAXTON COUNTY.

The Survey was unable to obtain any information on **Coal Test Borings Nos. 35 to 37 on Map II,** additional to that given in the table of borings for Braxton County. No. 37 is in **Holly District, Braxton,** on the south bank of Elk River, just below the mouth of Bee Run above Sutton. Nos. 35 and 36 are in Nicholas County, the former on the west bank of Birch River, 3 miles south of the Braxton-Nicholas County Line, and the latter, on Lick Run of Strange Creek, ¾ mile northeast of Dille P. O.

The following is the detailed log of a coal test boring that is republished with some changes in correlations from pages 483-4 of Volume II(A) of the State Survey Reports. It starts 80 to 85 feet below the Upper Kittanning Coal at **Opening No. 397 on Map II:**

Barley Fisher Coal Test Boring—No. 38 on Map II.

In Holly District, on east bank of Wolf Creek, 1½ miles above mouth of Left Fork, and 4.3 miles southeast of Sutton; elevation, 1115' B.

		Thickness. Ft.	In.	Total. Ft.	In.		
Surface		13	0	13	0		
Coal, Middle Kittanning		1	4	14	4	14'	4"
Slate, dark, with 2' of sandstone		13	4	27	8		
Coal 2' 2"	**Lower Kittanning, No. 5 Block ?** (1075' B.)	13	9	41	5	27'	1"
Fire clay 1 3							
Sand slate 6 11							
Slate, black 1 2							
Coal 2 3							
Fire clay		3	6	44	11		
Slate, sandy		3	1	48	0		
Coal 0' 2"	**Clarion.**	1	8	49	8		
Fire clay 0 10							
Coal 0 8							
Fire clay		4	4	54	0		
Slate, dark		11	0	65	0		
Sandstone, **Homewood**		29	0	94	0		
Fire clay		3	6	97	6		
Coal, bony		0	3	97	9		
Fire clay		2	6	100	3		
Sand shale and sandstone		15	7	115	10		
Coal, bony		1	0	116	10.	75'	5"
Fire clay		4	8	121	6		
Sandstone and sandy beds, some gas		32	0	153	6		
Slate, dark		1	6	155	0		
Shale, light-colored		12	0	167	0		
Sandstone, with thin streaks of coal		34	0	201	0		
Slate, black (Kanawha Black Flint horizon)		17	4	218	4		
Coal, Stockton?		0	6	218	10	102'	0"
Slate, sandy		5	2	224	0		
Fire clay		4	0	228	0		
Slate, sandy, to bottom		24	0	252	0	33'	2"

Since the above boring starts about 85 feet below the Upper Kittanning Coal, the Upper Kittanning—No. 5 Block interval—126 feet, base to base—is practically the same as that shown in the Palmer, Twistville-Diatter Run, and Glendon Sections, in Chapter IV, pages 97-8, 83-4, and 86-7, respectively. The coal at 13' 0" appears to be the same as that once mined commercially at Palmer—Opening No. 520 on Map II, where it belongs 160' to 170' above the undoubted Stockton Coal with its associated marine fossiliferous roof shales—Kanawha Black Flint; hence, in the boring, the Stockton Coal is tentatively correlated with the bed at 218' 4".

RECORD OF COAL TEST BORINGS IN CLAY COUNTY.

SUMMARIZED RECORDS.

In Clay County, 13 diamond drill borings have been sunk to test for coal, the detailed logs of only 5 of which were secured for the Survey. The following table gives a complete list of all the borings, grouped by magisterial districts, in addition to 2 others located in the adjoining portion of Kanawha County. As in Braxton, the elevation, location, and horizon of the well-mouth of each was determined in order to correlate the strata penetrated. The same explanations that accompany the table for the latter county, pages 460-1, apply to that for Clay:

Summarized Record of Coal

No. on Map II.	NAME OF PROPERTY	MAGISTERIAL DISTRICT	COMPANY	Elevation Above Sea-Level
39	J. M. Boggs core test	Otter		830B
40	Isaiah Good core test	Otter	Isaiah Good	820B
41	Isaiah Good core test	Otter	Isaiah Good	880B
42	Isaiah Good core test	Otter	Robt. Felty	1005B
43	Wm. Murphy core test	Buffalo	B. W. Perkins et al	1380B
44	Elk River Coal and Lumber Co. No. 2	Buffalo	Elk River C. & L Co	1075L
45	Elk River Coal and Lumber Co. No 1	Henry	Elk River C. & L. Co	1085B
45A	Hartland Colliery Co. No. 1	Pleasant	Hartland Colliery Co	1393L
45B	Hartland Colliery Co. No. 4	Pleasant	Hartland Colliery Co	1482L
45C	Hartland Colliery Co. No. 2	Pleasant	Hartland Colliery Co	1600L
46	Elk River Lumber Co. No. 3	Pleasant	Elk River Lumber Co	905B
47	Elk River Lumber Co. No. 2	Union	Elk River Lumber Co	1465B
48	Elk River Lumber Co. No. 1	Union	Elk River Lumber Co	1175B
49	J. Q. Dickinson No. 1	(Kanawha Co.)	J. Q. Dickinson	975B
50	J. Q. Dickinson No. 2	(Kanawha Co.)	J. Q. Dickinson	900B

DETAILED COAL TEST BORING RECORDS, OTTER DISTRICT (CLAY)

In Otter District, Clay County, four diamond drill borings had been completed in the latter part of 1915; viz, Nos. 39 to 42, inclusive, on Map II. The boring, the detailed log of which is given next below, starts 15 to 25 feet below the horizon of the Upper Freeport Coal, as determined by the writer, so that the bed at a depth of 96 feet undoubtedly represents the Upper Kittanning. The interval between the two coals last mentioned increases rapidly southward and southwestward across Clay County, attaining 160 feet at Strange Creek, 170 feet at Groves and Ivydale, and 175 feet at Clay and Queen Shoals. The Boggs boring (No. 39 on Map II) either did not quite reach down to the horizon of the No. 5 Block Coal or this bed is absent. The detailed log of the **J. M. Boggs No. 1 gas well—No. 111 on Map II**—published in Chapter IV in connection with the Big Otter Section, pages 107-109, indicates the presence of the latter bed and the absence of the Upper

Test Borings in Clay County.

UPPER FREEPORT COAL		UPPER KITTANNING COAL		No. 5 BLOCK-LOWER KITTANNING COAL		STOCKTON COAL		COALBURG COAL		Total Depth	No. on Map II.
Depth Top	Thickness	Depth Top	Thickness	Depth Top	Thickness	Depth Top	Thickness	Depth Top	Thickness		
96	5.5	....	....	....	....	....	....	....	....	219	39
....	....	....	....	....	....	....	....	....	....	——	40
....	....	....	....	....	....	....	....	....	....	——	41
....	....	....	....	....	....	....	....	....	....	——	42
....	....	....	....	175	9	295	5.5	....	....	——	43
....	....	....	....	....	....	....	....	....	....	——	44
....	....	....	....	....	....	....	....	....	....	758.1	45
....	....	275.6	3.7	448.8	2.5	529.6	2	——	——	577.3	45A
....	....	179.2	0.6	268.4	2.6	496.8	5.6	511.9	4.9	570.5	45B
....	....	59.1	1.2	284.5	1.9	351.6	1.5	425.2	5.1	605.4	45C
....	....	....	....	....	....	16	7	....	....	300	46
92	4	275	0	....	....	....	....	....	....	307	47
....	....	....	....	145	5	....	....	....	....	186.9	48
....	....	....	....	....	....	....	....	....	....	382.6	49
....	....	....	....	....	....	....	....	....	....	336.4	50

Kittanning Coal, a feature that should not be given too much weight, since oil and gas well drillers often pass through coal beds at night without recording them.

J. M. Boggs Core Test Boring—No. 39 on Map II.

In Otter District, Clay County, 1.7 miles southwest of Big Otter, on west bank of Otter Creek; authority, J. M. Boggs; completed, November 15, 1901; elevation, 830′ B.

	Thickness. Feet.	Total. Feet.	
Soil, gravel, and drift	16	16	
Sandstone, Upper Freeport	18	34	
Fire clay, excellent quality?	15	49	
Slaty shale	26	75	
Coal Upper Kittanning "Rider"	1	76	
Slate and sandstone	20	96	
Coal, good, "O'Brien Creek," Upper Kittanning	5.5	101.5	101.5′
Slate	2.5	104	
Sandstone, Upper East Lynn	88	192	90.5′
Slate, white	17	209	
Sandy slate	4	213	
Sandstone, Homewood?, to bottom	6	219	27′

No information additional to that given in the Clay County table of borings on a preceding page of this Chapter was obtained for **Coal Test Borings Nos. 40 to 42, inclusive, on Map II,** all of which are located in the southeast corner of Otter District (Clay), slightly over a mile southwestward from Villa Nova.

DETAILED COAL TEST BORING RECORD, BUFFALO DISTRICT.

In the latter part of 1915, only two diamond drill holes—**Nos. 43 and 44 on Map II**—had been completed. The Survey was unable to obtain any information additional to that given in the table above mentioned for the latter boring.

William Murphy Core Test Record—No. 43 on Map II.

In Buffalo District, 1.8 miles northward from Widen and 0.6 mile due south of Wattsville; drilled by B. W. Perkins et al.; authority, Walker Wilson; elevation, 1380′ B.

	Thickness. Feet.	Total Depth. Feet.
Coal, No. 5 Block	9	184
Coal, Clarion	3.5	227.5
Coal, Stockton	5	300.5

The Survey was unable to obtain the detailed log of the above boring, the results published being figures that were given the writer by Walker Wilson, residing in the immediate region, as the latter overheard the driller reporting the same on the telephone. It starts 135 feet below the top of the outcropping Upper Freeport Sandstone cliff, as determined by the writer, and the interval at Widen between the top of the latter member and the base of the No. 5 Block Coal bed is about 330 feet, a result that corroborates the presence of the latter seam in the above boring at a depth of 185 to 190 feet. Hence, it is very probable that the record as published is in close harmony with the facts, any partings, of course, that each seam might have contained being included in the total thickness of the bed.

DETAILED COAL TEST BORING RECORD, HENRY DISTRICT.

In Henry District, Clay County, only one coal test boring had been completed in November, 1915; viz, **Elk River Coal**

and Lumber Co. No. 1—No. 45 on Map II—the detailed log of which is published in Chapter IV in connection with the Beech Fork of Lilly Section, pages 139-142.

DETAILED COAL TEST BORING RECORDS, PLEASANT DISTRICT.

In Pleasant District, Clay County, as in that last described, only one coal test boring had been completed in November, 1915. It starts 310 to 325 feet below the horizon of the Upper Kittanning Coal bed, as determined by the writer, and 5 to 10 feet above that of the Kanawha Black Flint. Its detailed log, as furnished Henry B. Davenport by Peter Carroll of Charleston, West Virginia, follows:

Elk River Lumber Co. Boring No. 3—No. 46 on Map II.

In Pleasant District, at forks of Lick Branch of Adonijah, 2.3 miles northwest of Lizemores; drilled by Elk River Lumber Co.; elevation, 905' B.

			Thickness.		Total.			
			Ft.	In.	Ft.	In.		
Surface			8	0	8	0		
Slate			8	0	16	0		
Coal	1' 4"	Stockton..	7	0	23	0	23'	0"
Slate	1 0							
Coal	0 10							
Slate	2 6							
Coal	1 4							
Shale			20	0	43	0		
Sandstone, Upper Winifrede			53	0	96	0		
Shale			17	0	113	0		
Sandstone, Lower Winifrede			50	0	163	0		
Slate			10	0	173	0		
Coal, Chilton			2	0	175	0	152'	0"
Slate			4	0	179	0		
Sandstone, Williamson			17	0	196	0		
Shale			18	0	214	0		
Slate			9	0	223	0		
Coal, Williamson			3	0	226	0	51'	0"
Slate			26	0	252	0		
Sandstone, Upper Cedar Grove			19	8	271	8		
Coal, Cedar Grove			4	0	275	8	49'	8"
Slate			12	0	287	8		
Shale			10	0	297	8		
Sandstone to bottom			3	0	300	8	25'	0"

The above boring is located within 5 feet and starts flush with the top of oil and gas test boring **No. 133 on Map II**, the detailed log of which is published in Chapter IV in connection with the Lick Branch of Adonijah Section, pages 149-153. Although the records of the two borings agree in some of their main features, yet it is difficult to understand some of the discrepancies, since, according to Mr. Davenport, a special effort was made to keep an accurate log of the oil and gas test well, a man being employed for that purpose only.

The three following records of coal test borings in the eastern border of Pleasant District were sunk during the latter part of 1916 and the early part of 1917, the detailed logs of which were kindly furnished the Survey by Marcy McD. Price, Vice-President and General Manager of the Hartland Colliery Company:

Hartland Colliery Co. Coal Boring No. 1 (No. 45A on Map II).

In Clay County, on ridge, ½ mile southeast of mouth of Middle Creek; authority, M. McD. Price; completed in November, 1916; elevation, 1393' L.

	Thickness.		Total.			
	Ft.	In.	Ft.	In.		
Surface	3	0	3	0		
Surface	2	7	5	7		
Rotten sandstone, **Upper Mahoning**	14	3	19	10		
Rotten green shale	3	2	23	0		
Slate	0	6	23	6		
Shale and fire clay, **Thornton**	4	1	27	7		
Green shale	5	8	33	3		
Green shale and sandstone	13	6	46	9		
Green and red shale	10	6	57	3		
Green shale	11	0	68	3		
Shale	11	10	80	1		
Sandstone, **Lower Mahoning**	32	1	112	3	112'	3"
Sandstone ....37' 6" Sandstone, conglomerate mixed....21 5 } **Upper Freeport**	58	11	171	2		
Shale	5	3	176	5		
Shale, very soft	5	10	182	3		
Shale, very soft	3	10	186	1		
Shale, sandy	22	6	208	7		
Sandstone, **Lower Freeport**	64	7	273	2		
Slate	2	5	275	7		
Coal, Upper Kittanning, (1114' L.)	3	8	279	3	167'	0"
Slaty fire clay	2	0	281	3		
Slate	2	0	283	3		
Sandstone, conglomerate	9	2	292	5		
Sandstone	52	5	344	10		
Sandstone, **coal partings, Middle Kittanning**	6	0	350	10	71'	7"
Sandstone	19	3	370	1		
Sandstone, **coal parting**	11	0	381	1		

		Thickness. Ft.	In.	Total. Ft.	In.	
Sandstone, coal parting		19	3	400	4	
Sandstone, coal parting		20	8	421	0	
Sandstone		27	9	448	9	
Bony coal......1' 3" Coal ......0 7 Slate ......0 2½ Coal 0 5	**No. 5 Block**	2	5½	451	2½	100' 4½"
Soft shale		1	11	453	1½	
Sandy shale		3	7½	456	9	
Shale, very soft		8	0	464	9	
Bastard lime		0	8	465	5	
Shale		5	5	470	10	
Slaty shale		1	3	472	1	
Coal, No. 5 Block, Lower Bench		0	9	472	10	21' 7½"
Fire clay and shale		1	10	474	8	
Fire clay and shale		5	0	479	8	
Shale		0	11	480	7	
Sandstone		5	7	486	2	
Slate, shale, and fire clay		4	1	490	3	
Slaty shale		3	5	493	8	
Sandstone		7	9	501	5	
Slate		0	2	501	7	
Coal ....0' 5" Slate, little coal 1 0	**Stockton "A".**	1	5	503	0	
Sandstone		19	11	522	11	
Slate, soft, **Kanawha Black Flint horizon?**		6	8	529	7	
Coal ....1' 0" Sulphur and slate....0 1 Coal ....0 3 Slate ....0 2 Bone and slate......0 6	**Stockton?**	2	0	531	7	58' 9"
Fire clay		2	1	533	8	
Fire clay, sandy		7	2	540	10	
Sandstone, **Upper Coalburg?**, to bottom		36	6	577	4	45' 9"

The above boring evidently stopped not over 5 to 10 feet above the Coalburg Coal, judging from its position as exhibited in the section for Clay, pages 129-132.

Hartland Colliery Co. Boring No. 4 (No. 45B on Map II).

Pleasant District, Clay County; on ridge, 0.6 mile S. 70°-80° E. of mouth of Lick Fork of Middle Creek; authority M. McD. Price; completed, March, 1917; elevation, 1482′ L.

		Thickness.		Total.			
		Ft.	In.	Ft.	In.		
Surface		5	0	5	0		
Sandstone, rotten... 7′ 0″	Upper Freeport	68	0	73	0		
Sandstone, rotten...29 0							
Sandstone, pea conglomerate 32 0							
Shale, green		3	0	76	0		
Shale, mixed		2	0	78	0		
Shale		4	0	82	0		
Sandstone, streaks of shale		5	8	87	8		
Shale		13	4	101	0		
Sandstone and shale		4	0	105	0		
Sandstone ....43′ 9″	Lower Freeport	56	4	161	4		
Sandstone and conglomerate 12 7							
Shale		1	1	162	5		
Coal, bony, Upper Kittanning "Rider"		0	4	162	9		
Shale and fire clay		6	6	169	3		
Shale		1	5	170	8		
Shale, very soft		8	0	178	8		
Coal, bony, Upper Kittanning		0	7	179	3	179′	3″
Shale, sandy		8	2	187	5		
Sandstone ....23′ 10″	Upper East Lynn	101	11	289	4		
Sandstone, pea conglomerate 22 6							
Sandstone 55 7							
Coal		0	8	290	0		
Shale, slaty		4	7	294	7		
Shale		1	7	296	2		
Coal ....1′ 10″	**Middle Kittanning**	6	1	302	3	123′	0″
Slate 0 2							
Coal 4 1							
Fire clay		3	7	305	10		
Sandstone and shale		13	9	319	7		
Sandstone		25	0	344	7		
Sandstone		23	9	368	4		
Coal, No. 5 Block		2	7	370	11	68′	8″
Sandstone		25	10	396	9		
Coal, Little No. 5 Block		0	9	397	6		
Shale		2	9	400	3		
Sandstone and shale		10	6	410	9		
Sandstone		25	10	436	7		
Shale		8	6	445	1		
Sandstone and shale		17	2	462	3		
Sandstone		3	0	465	3		
Shale, slaty		1	5	466	8		
Slate, little seams of coal		0	10	467	6		
Coal, Stockton "A"		3	9	471	3		
Shale		6	5	477	8		
Sandstone		13	0	490	8		

		Thickness. Ft.	In.	Total. Ft.	In.		
Shale, slaty, micaceous, marine fossils, Kanawha Black Flint......		6	1	496	9	125'	10"
Coal ....2' 4"	**Stockton**	5	7	502	4		
Shale 0 3							
Coal 3 0							
Shale, streaked with **coal**...........		3	6	505	10		
Shale		5	7	511	5		
Slate, little seams of **coal**..........		0	6	511	11		
Coal ....2' 4"	**Coalburg**	4	11	516	10	20'	1"
Slate 0 4							
Coal, splint..........2 3							
Sandstone and shale...............		10	11	527	9		
Shale		4	0	531	9		
Shale with **coal**....0' 4"	**Little Coalburg**	4	5	536	2	19"	4"
Coal 0 10							
Shale 0 2							
Coal 3 1							
Shale, sandy......................		1	5	537	7		
Sandstone		3	8	541	3		
Sandstone and shale...............		6	6	547	9		
Sandstone to bottom...............		22	9	570	6	34'	4"

The above boring—No. 45B on Map II—was visited by the writer March 30, 1917, the coal examined and the position of the Kanawha Black Flint with its associated marine fossils determined at a depth of 490' 8". This record, as also that next below, establishes the fact that the big bed at 296' 2" belongs 180 to 195 feet above the base of the Kanawha Black Flint and 100 to 120 feet above the No. 5 Block Coal on Middle and Leatherwood Creeks.

Hartland Colliery Co. Boring No. 2 (No. 45C on Map II).

Located in the southeast corner of Pleasant District, Clay County, on ridge between Sycamore and Middle Creeks, 1.5 miles due south from the Rosetta Schoolhouse; completed, December 27, 1916; elevation, 1600' L.

	Thickness. Ft.	In.	Total. Ft.	In.
Surface	6	0	6	0

				Thickness.		Total.			
				Ft.	In.	Ft.	In.		
Sandstone, rotten, yellow and brown...	5'	8"	Lower Freeport..	48	8	54	8		
Sandstone, gray and brown	8	8							
Sandstone and pea conglomerate, coarse.	20	11							
Shale and pea conglomerate	1	6							
Shale, black, and sandstone	4	3							
Sandstone, grayish-white	7	8							
Shale, black, and sandstone........				4	5	59	1		
Coal, bone streak near top, Upper Kittanning				1	2	60	3	60'	3"
Sandstone, pebbly, coarse, and grayish-white	42'	7"	Upper East Lynn	122	5	182	8		
Sandstone and shale.	5	5							
Sandstone, grayish-white	19	5							
Shale, sandy, trace of coal 9" above bottom	6	11							
Shale and sandstone, mixed	13	4							
Shale	6	2							
Sandstone, fine.......	4	0							
Sandstone, medium-grained to coarse, gray to grayish-white at bottom..	24	9							
Coal	1'	2"	Middle Kittanning.	2	5	185	1	124'	10"
Shale and coal..	0	10							
Coal	0	5							
Shale, sandy.......................				12	11	198	0		
Sandstone, medium-grained, gray.....	44'	3"	East Lynn	72	5	270	5		
Sandstone, with a little pea conglomate, top grayish-white	11	3							
Sandstone	16	11							
Coal, shaly and bony, No. 5 Block....				1	2	271	7	86'	6"
Shale, sandy......................				2	0	273	7		
Sandstone, grayish-white, medium-grained				7	10	281	5		
Shale				3	0	284	5		
Coal, No. 5 Block, Lower Bench....				1	11	286	4	14'	9"
Shale, bluish-gray.................				7	0	293	4		
Sandstone, medium-grained, gray...				5	11	299	3		
Shale, dark-gray..................				14	3	313	6		
Sandstone, medium-grained, grayish-white, Homewood.............				38	1	351	7		

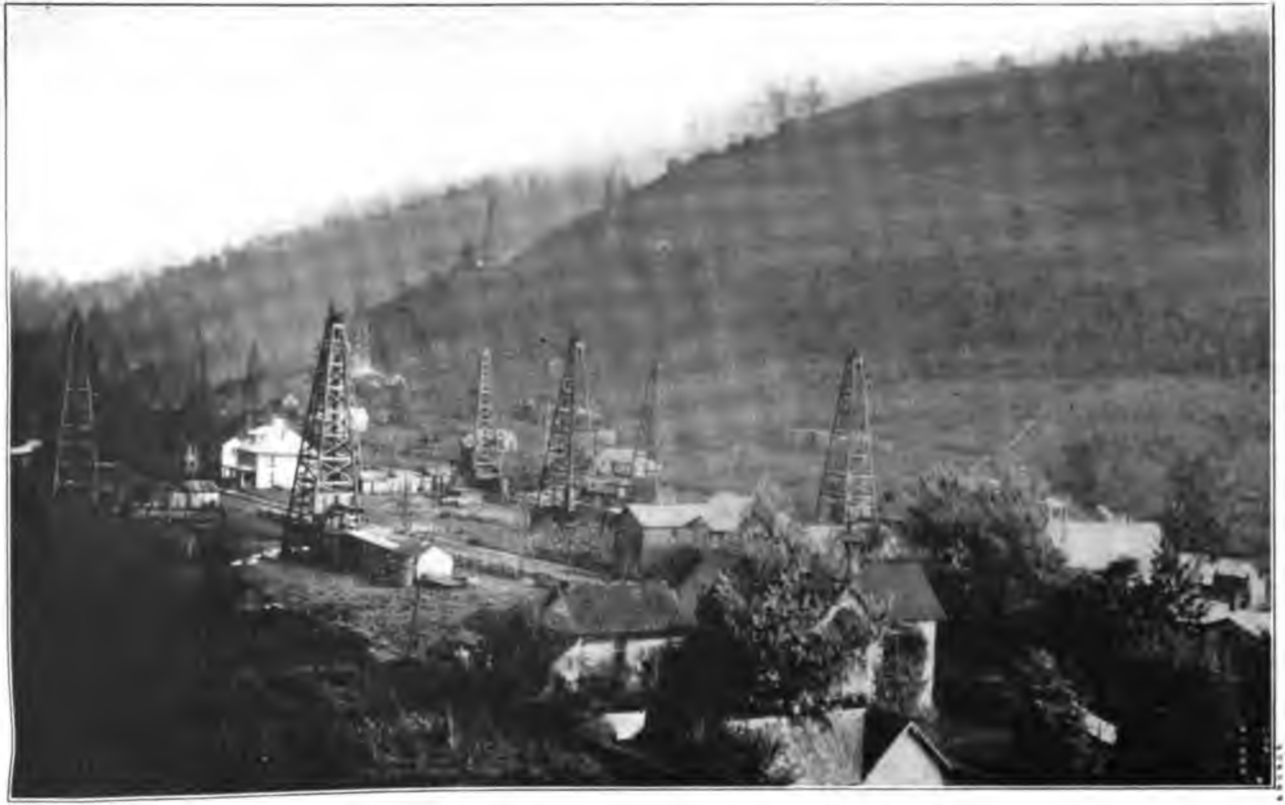

PLATE XVIII.—Showing oil wells at Rosedale, Braxton County; topography of the Monongahela and Conemaugh Series.

	Thickness.		Total.		
	Ft.	In.	Ft.	In.	
Coal ....1' 2 " Coal and slate ....0 3½ } Stockton "A".	1	5½	353	0½	66' 8½"
Sandstone and shale...............	6	0½	359	1	
Shale, black.......................	4	0	363	1	
Slate, black, siliceous, marine fossils, Kanawha Black Flint......	2	2	365	3	
Coal, Stockton.....................	0	10	366	1	13' 0½"
Shale, sandy........................	4	10	370	11	
Sandstone, fine-grained, gray.......	6	1	377	0	
Sandstone and shale...............	10	0	387	0	
Shale, slaty, soft, bluish-gray.......	14	5	401	5	
Sandstone, grayish-white, medium-grained	16	4	417	9	
Shale, slaty, bluish-black...........	4	11	422	8	
Sandstone, coarse-grained, white....	2	6	425	2	
Coal ....1' 10" Shale, soft, little streaks of coal.1 7 Coal ....1 8 } Coalburg	5	1	430	3	64' 2"
Slate, soft, dark-gray..............	1	4	431	7	
Sandstone and slate...............	12	1	443	8	
Coal	0	3	443	11	
Shale, bluish-black................	2	0	445	11	
Sandstone and shale...............	1	11	447	10	
Coal	0	6	448	4	
Sandstone and shale...............	8	5	456	9	
Coal	0	1	456	10	
Sandstone and shale...............	2	8	459	6	
Coal	0	9	460	3	
Sandstone and shale...............	7	8	467	11	
Sandstone, medium-coarse, grayish-white	23	1	491	0	
Shale, bluish-black.................	1	7	492	7	
Coal, Winifrede.....................	1	6	494	1	63' 10"
Sandstone and shale...............	11	0	505	1	
Coal ....1' 11" Shale, little streaks of coal.......5 0 } Lower Winifrede.	6	11	512	0	17' 11"
Shale and sandstone...............	3	1	515	1	
Sandstone, medium-grained, grayish-white, with one or two coal streaks	73	11	589	0	
Slate, bluish-black, streaks of sandstone	11	1	600	1	
Fire clay and shales...............	2	9	602	10	
Shale, sandy, to bottom of hole.....	2	6	605	4	93' 4"

The above boring was visited by the writer in December, 1916, the core carefully examined, and the horizon of its well-mouth determined to be about 15 feet below the base of the conglomeratic Upper Freeport Sandstone which forms a conspicuous bluff and strews the ground with large boulders just west of the boring.

DETAILED COAL TEST BORINGS, UNION DISTRICT (CLAY).

In Union District, Clay County, only 2 coal test borings had been sunk previous to November, 1915, the detailed logs of which, as furnished Henry B. Davenport by Peter Carroll, of Charleston, West Virginia, are given below:

Elk River Lumber Co. Core Test Boring No. 2
No. 47 on Map II.

In Union District, on ridge in extreme head of Wade Fork, 2 miles slightly south of west from Warfield; drilled by Elk River Lumber Co.; elevation, 1465' B.

			Thickness.		Total.		
			Ft.	In.	Ft.	In.	
Surface			2	0	2	0	
Sandstone, Upper Mahoning			33	0	35	0	
Slate			8	0	43	0	
Lime, Sutton			0	6	43	6	
Slate			6	6	50	0	50'
Coal, Mahoning			0	6	50	6	
Fire clay			1	0	51	6	
Sandstone Slate Sandstone	4' 6" 14 0 22 0	Lower Mahoning	40	6	92	0	
Coal Sandstone Slate Coal	0' 3" 1 0 0 9 2 0	Upper Freeport	4	0	96	0	46'
Sandstone Shale Sandstone	10' 12 32	Upper Freeport	54	0	150	0	
Slate			16	6	166	6	
Coal, Lower Freeport			0	6	167	0	71'
Slate			13	6	180	6	
Shale			0	6	181	0	
Slate			4	0	185	0	
Sandstone, Lower Freeport			69	0	254	0	87'
Black shale, horizon of Upper Kittanning Coal			17	0	271	0	
Slate			4	0	275	0	
Fire clay, Upper Kittanning			1	0	276	0	
Sandstone Sandstone, light, to bottom	9' 22	Upper East Lynn	31	0	307	0	53'

As near as could be determined on the ground by the writer, the above boring starts about 260 feet above the outcrop of the Upper Kittanning Coal, so that the latter bed undoubtedly belongs at the horizon of the **black shale** member, 254 feet from the top. The log is very important, in that complete details are given for the Mahoning Sandstone stage of the Conemaugh, as also the same for the upper two-thirds of the Allegheny Series.

Elk River Lumber Co. Core Test Boring—No. 48 on Map II.

In Union District, Clay County, on Left Fork of Spruce, 0.3 mile southwest of Spruce Low Gap; drilled by Elk River Lumber Co.; elevation, 1175' B.

	Thickness.		Total.	
	Ft.	In.	Ft.	In.
Surface	7	0	7	0
Shale	28	0	35	0
Sandstone	2	0	37	0
Shale	15	0	52	0
Sandstone	42	0	94	0
Slate	26	0	120	0
Sandstone	17	0	137	0
Slate	3	0	140	0
Coal ....0' 3" Fire clay....2 9 Coal ....2 0 No. 5 Block	5	0	145	0
Fire clay	1	3	146	3
Slate	7	0	153	3
Sandstone	2	0	155	3
Slate	9	8	164	11
Coal ....3' 10" Slate ....0 2 Coal ....0 8 Little No. 5 Block-Clarion.	4	8	169	7
Slate	7	8	177	3
Sandstone, Homewood, to bottom..	9	7	186	10

The above boring, examined by Gawthrop, starts 50 feet below an opening in the Upper Kittanning Coal and thus gives a close measurement of the interval between the latter and the No. 5 Block bed, or a result that agrees closely with outcrop measurements throughout southern Clay County. The correlation of the latter seam is further corroborated by the presence of a fair coal seam 19 feet lower in the measures, a feature that accompanies the No. 5 Block Coal, in the southeast portions of Buffalo, Henry, and Pleasant Districts, Clay County.

The detailed logs of the **John Q. Dickinson Nos. 1 and 2 Core Test Borings—Nos. 49 and 50 on Map II**—located along

Bells Creek in Kanawha County, 2 miles northwest and 0.4 mile northwest of the common corner of Clay, Kanawha, Fayette, and Nicholas Counties, are published under Nos. 681 and 682 on pages 570 and 571, respectively, of the Kanawha County Report, to which reference is made for details of the Kanawha Group of the Pottsville Series.

MINABLE COALS OF THE MONONGAHELA SERIES.

THE PITTSBURGH COAL.

The Pittsburgh Coal, described briefly in Chapter V, page 180, is the only bed of the Monongahela Series that appears to attain minable dimensions and purity in Braxton and Clay Counties. Its approximate minable area is outlined on Figure 4 along with that of the Eagle seam. This shows it to be confined to the northwest portions of each County, and that even here there occurs a considerable barren area in the northern part of Birch and the northwest portion of Otter District, Braxton, as exhibited by its limited outcrop in this region on Map II and on Figure 4. In both counties it has been opened extensively at country banks for local domestic fuel and on Copen Creek, has been mined commercially since the construction of the Coal and Coke Railway in 1906. Its thickness and structure at these mines and diggings as also crop exposures will now be described by magisterial districts.

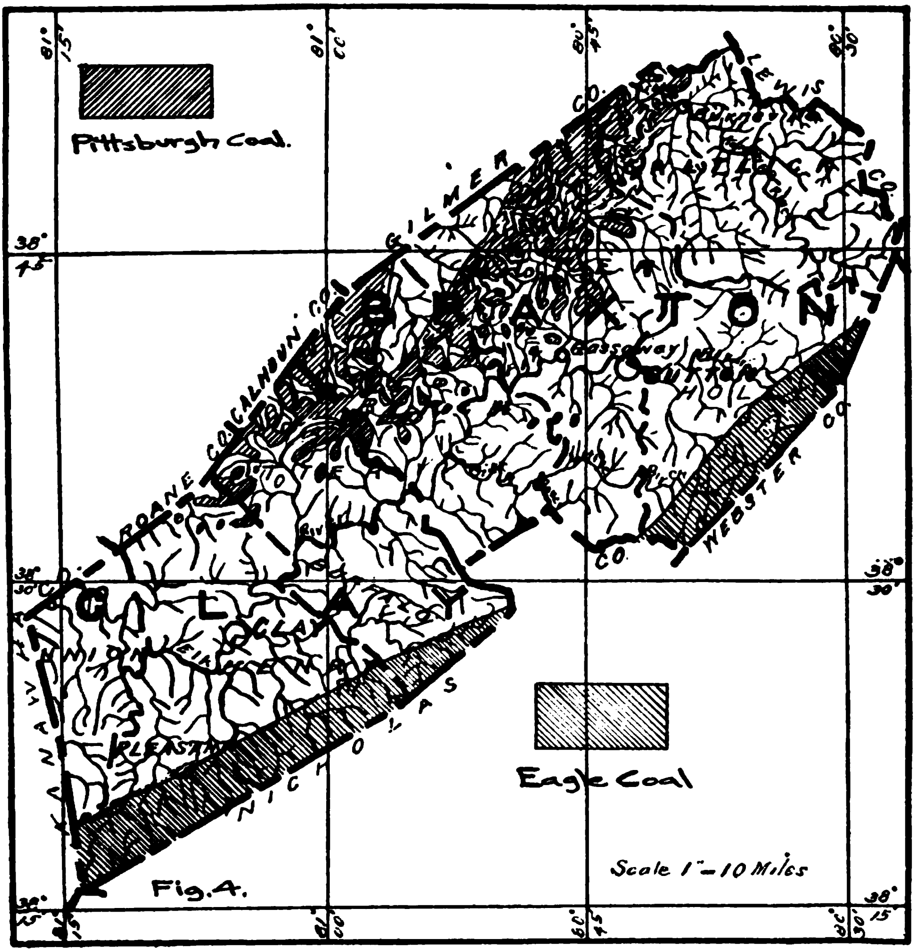

Figure 4.—Map Showing Approximate Minable Area of the Pittsburgh and Eagle Coals. (See Explanations in Author's Preface).

Salt Lick District, Braxton County.

In Salt Lick District, the minable area of the Pittsburgh Coal is confined to a small region in the western border where it has already been mined commercially. The two following openings on it were examined by Gawthrop:

Copen Creek Coal Co. Mine—No. 89 on Map II.

On east side of Copen Run, 0.4 mile above Braxton-Gilmer County Line; **Pittsburgh Coal**; elevation, 865′ B.

			Ft.	In.
Coal, roof (shale roof)	0′	6″		
Coal	1	0		
Coal, slaty	1	0		
Coal (fire clay shale floor)	3	0	5	6

Davis Colliery Co. Mine No. 6—No. 90 on Map II.

On branch of Copen Run, 1 mile southwest of Mine No. 89 above; **Pittsburgh Coal**; butts, S. 75° E.; faces, S. 15° W.; greatest rise, S. 30° E.; elevation, 860′ B.

			Ft.	In.
Shale, gray, visible			5	0
Coal	1′	6″		
Bone	0	3		
Coal, medium-hard	1	6		
Coal, harder	1	9		
Coal, softer (fire clay shale floor)	1	3	6	3

The writer in 1907 measured the opening at the above mine and the results were published in Volume II(A), pages 664-5, of the Survey Reports, under Mine No. 10 of above Company, as follows:

				Ft.	In.
1.	Slate, bad roof				
2.	**Coal**, hard, 6″ to	1′	5 ″		
3.	Bone	0	1⅛		
4.	**Coal**, hard	3	8	5	2⅛
5.	Slate, shales, sandstone, and red rock, no coal (in boring near opening, water well)			230	0

The analysis of a sample collected from Nos. 2, 3, and 4 of the above section, as published under No. 10 on page 668 of Volume II(A), is republished under **No. 90** in the table of analyses at the end of this Chapter.

The sections shown at the three following country banks, in Salt Lick District, are determinations by Gawthrop:

Tacy Robinson Coal Opening—No. 91 on Map II.

On branch of Copen Run, 1¼ miles due south of Mine No. 89 above; Pittsburgh Coal; elevation, 945′ B.

			Ft.	In.
Coal, roof (dark-gray shale roof)	1′	3″		
Bone, left up	0	2		
Coal, good (fire clay shale floor)	4	2	5	7

Albert Shock Coal Opening—No. 92 on Map II.

On branch of Copen Run, 0.3 mile east of Mine No. 91 above; Pittsburgh Coal; elevation, 960′ B.

			Ft.	In.
Shale, gray, visible			3	0
Coal, roof, left up				
Coal	0′	8″		
Bone, 1″ to	0	2		
Coal, medium-hard (fire clay shale floor)	4	3	5	1

"Not in far enough to sample."

G. B. Carter Coal Opening—No. 93 on Map II.

On branch of Copen Run, 0.8 mile northeast of Copen; Pittsburgh Coal; butts, N. 75° W.; faces, N. 15° E.; elevation, 945′ B.

				Ft.	In.
1.	Shale			2	0
2.	Coal, slaty, roof, at entrance, left up	2′	0″		
3.	Coal, medium-soft	0	9		
4.	Coal, bony	0	4		
5.	Coal, hard	1	6		
6.	Coal, medium-hard (shale floor)	2	8	7	3

The analysis of a sample (161G) collected from Nos. 3, 5, and 6 of above section, as reported by Messrs. Hite and Krak, is given under **No. 93** in the table of analyses at the end of this Chapter.

The following commercial mine was examined by Gawthrop:

Davis Colliery Co. Mine No. 11—No. 94 on Map II.

On east hillside of Copen Run, 0.4 mile due north of Copen; **Pittsburgh Coal**; butts, S. 84° E.; faces, S. 6° W.; greatest rise, S. 30° E.; elevation, 950′ B.

				Ft.	In.
1.	Shale, dark-gray			10	0
2.	**Coal**, medium-soft	2′	10″		
3.	Bone, 4″ to	0	2		
4.	**Coal**, good, harder, reported	4	0	7	0
5.	Fire clay shale floor				

The writer in 1907 measured the opening at the above mine and the results were published in Volume II(A), page 664, of the Survey Reports, as follows:

				Ft.	In.
1.	Slate, fair roof			2	9
2.	**Coal**, hard, 2′ 2″ to	2′	9″		
3.	Bone, 1½″ to	0	2		
4.	**Coal**, hard	0	6		
5.	Bone, 0″ to	0	1		
6.	**Coal**, hard (to slate floor)	3	2	6	8

The analysis of a sample collected from Nos. 2, 3, 4, 5, and 6 of the above section, as published under No. 9 on page 668 of Volume II(A) of the Survey Reports, is republished under **No. 94** in the table of analyses at the end of this Chapter.

The following table of analyses has been kindly furnished the Survey by Mr. C. E. Scott of Junior, West Virginia, Chemist for the Davis Colliery Company, as published in Volume II(A), page 667:

Pittsburgh Coal—Braxton County.

Location	Thickness	Moisture	Vol. Mat.	Fixed Carbon	Ash	Sulphur
Copen Run	6′ 6″	1.56	39.75	52.88	5.81	2.27
Slab Camp Run	5 10	1.64	39.91	51.94	6.51	2.51
Venison Fork of Cedar Creek	5 6	1.69	39.35	54.10	4.86	2.31
Trace Run	5 2	1.70	39.15	53.52	5.63	1.96
Cedar Creek (mouth of Moyer)	4 6	1.58	38.01	53.91	6.50	2.71
Cedar Creek (mouth of Moyer)	4 8	1.81	38.63	53.96	5.60	2.01

"Mr. Scott also states that the **Phosphorus** in the Pittsburgh Coal on Copen averages 0.016."

The eleven following prospect openings and country banks were examined by Gawthrop on the waters of Copen Run:

The **Davis Colliery Company Opening—No. 95 on Map II**—located on a west branch of Copen Run, ¾ mile northwest of Copen, in the Pittsburgh Coal, at an elevation of 930′ B., was closed when visited by Gawthrop.

G. J. Wright Coal Opening—No. 96 on Map II.

On west hillside of Copen Run, at Copen; **Pittsburgh Coal**; elevation, 925′ B.; Coal, with bone parting, opening closed, but reported by Mr. Wright 7′ 0″ thick.

Alfred Carter Heirs Prospect—No. 97 on Map II.

On east hillside of Bull Fork, 0.4 mile southwest of Copen; **Pittsburgh Coal**; elevation, 940′ B.; opening closed, reported 2′ 0″ thick.

Alfred Carter Heirs Prospect—No. 98 on Map II.

On west side of Bull Fork, 0.8 mile southwest of Copen; **Pittsburgh Coal**; elevation, 970′ B.; closed, reported 1′ 8″ thick.

M. E. McConkey Coal Opening—No. 99 on Map II.

On east hillside of Bull Fork, 1.1 miles S. 15° W. of Copen; **Pittsburgh Coal**; elevation, 990′ B.; closed, reported 1′ 8″ to 2′ 0″ thick.

James Dennison Coal Opening—No. 100 on Map II.

On north side of road, 2.1 miles due west of Gem P. O. (Cogers); **Pittsburgh Coal**; elevation, 1005′ B.

			Ft.	In.
Shale, dark-gray, visible			5	0
Coal, slaty roof	0′	10″		
Coal	1	0		
Bone coal	0	3		
Coal (to fire clay shale floor)	2	4	4	5

"Further in the above mine, the coal thins down to 3 feet."

Charles Pullion Coal Opening—No. 101 on Map II.

On north edge of road, 0.2 mile southeast of Opening No. 100 above; **Pittsburgh Coal**; elevation, 1020′ B.

			Ft.	In.
Shale, gray, visible			5	0
Coal, roof	0′	6″		
Coal, medium-hard	1	10		
Bone coal	0	2		
Coal, medium-hard (shale floor)	2	8	5	2

"The coal is badly broken by clay veins."

Shade Nicholson Coal Opening—No. 102 on Map II.

On east side of branch, 1.7 miles southeast of Copen; **Pittsburgh Coal**; elevation, 1030′ B.

			Ft.	In.
Shale, dark-gray, visible			5	0
Coal, roof	1′	0″		
Coal	1	6		
Bone	0	4		
Coal (to fire clay shale floor)	2	5	5	3

W. T. Davis Coal Opening—No. 103 on Map II.

On west hillside of Copen Run, 1.0 mile southward from Copen; **Pittsburgh Coal**; butts, N. 75° W.; faces, N. 15° E.; elevation, 955′ B.

			Ft.	In.
Sandstone, flaggy, visible			5	0
Shale, dark			6	0
Coal	0′	10″		
Coal, bony, 0″ to	0	1		
Coal (to fire clay shale floor)	2	6	3	5

G. W. Stout Coal Opening—No. 104 on Map II.

On east hillside of Copen Run, ¾ mile north of Coal and Coke Railway tunnel; **Pittsburgh Coal**; elevation, 1020′ B.; closed, reported by Mrs. Stout 6′ 0″ thick.

H. A. Post Coal Prospect—No. 105 on Map II.

0.5 mile southeast of Opening No. 104 above; **Pittsburgh Coal**; elevation, 1040′ B.; closed, reported 2′ 6″ to 4′ 0″ thick.

The four following prospects and country banks, located on waters of Hyers Run, were examined by Gawthrop:

Albert Shock Coal Prospect—No. 106 on Map II.

On branch of Hyers Run, 0.8 mile due south of mouth of the latter; **Pittsburgh Coal**; elevation, 945′ B.; closed, **reported** 3′ 0″ thick.

Herbert Nicholson Coal Opening—No. 107 on Map II.

On west hillside of Hyers Run, 2.5 miles southeast of Burnsville; **Pittsburgh Coal**; elevation, 990′ B.

	Ft.	In.
Shale, dark-gray, visible	5	0
Coal, good	3	1
Fire clay shale floor		

John Nutter Coal Opening—No. 108 on Map II.

On east hillside of Hyers Run, ¼ mile due south of Opening No. 107 above; **Pittsburgh Coal**; elevation, 1000′ B.

			Ft.	In.
Shale, visible			5	0
Coal, medium-soft	1′	4″		
Coal, slaty	0	2		
Coal, good (shale floor)	2	8	4	2

The Pittsburgh Coal is reported one foot thick at an elevation of 870′ B., at **Opening No. 109 on Map II**, on the east hillside, 1.2 miles up Longshoal Run.

The five following openings, examined by Gawthrop, are located on the waters of Saltlick Creek, in Salt Lick District:

A. J. Knight Coal Opening—No. 110 on Map II.

On east hillside of Saltlick Creek, 0.6 mile southwest of Burnsville; **Pittsburgh Coal**; elevation, 1015′ B.; on slight bench at foot of steep slope, opening closed, **reported** 1′ 6″ thick.

Bud Bosley Coal Opening—No. 111 on Map II.

On west side of hill road, 1.6 miles S. 75° W. of Gem (Cogers); **Pittsburgh Coal**; elevation, 1030′ B.; closed, **reported** 3′ 0″ to 4′ 0″ thick.

Ert Singleton Coal Prospect—No. 112 on Map II.

On head of Left Fork, 3.0 miles S. 30° W. of Gem (Cogers); **Pittsburgh Coal**; elevation, 1055′ B.

	Ft.	In.
Sandstone, massive, gray, visible	10	0
Shale, dark-gray	4	0
Limestone, hard, sandy	1	0
Shale, soft, argillaceous	2	6
Coal, visible	0	8
Coal, concealed by water, thickness not known		

S. J. Singleton Coal Prospect—No. 113 on Map II.

On head of Left Fork, 0.5 mile southeast of Opening No. 112 above; **Pittsburgh Coal**; elevation, 1075′ B.

	Ft.	In.
Shale, dark, siliceous, visible	12	0
Shale, gray, argillaceous	3	0
Slate, black (to shale floor)	1	0

"Opening driven in 200 feet but very little coal found."

Gawthrop reports the blossom of the Pittsburgh Coal at an elevation of 1110′ B., at **Exposure No. 114 on Map II,** on head of Burns Fork, 1.9 miles N. 75° W. of Rollyson, 70′ above Opening No. 5 on Map II in the Little Pittsburgh Coal.

Otter District, Braxton County.

In Otter District, the Pittsburgh Coal has been opened by natives even more extensively than in Salt Lick, its thickness and stratigraphic position being shown in the Sections 1 Mile Northwest of Braxton, 1 Mile North of Braxton, and Sugar Knob, published in Chapter IV, pages 60-1, 61, and 64, respectively. As shown on Figure 4 and in detail on Map II, there is an apparent barren area extending 4 to 5 miles southward from the northern point of the District, with a width of 2 to 3 miles. The five following openings on the waters of Bull Run of Cedar Creek were examined by Gawthrop:

French West Coal Opening—No. 115 on Map II.

On Bull Run, 0.2 mile southeast of Waldeck; **Pittsburgh Coal**; elevation, 845' B.

	Ft.	In.
Coal, opening closed, reported	2	6
Concealed to bed of run	5	0

Wise Moyers Coal Opening—No. 116 on Map II.

On Bull Run, ¾ mile southeast of Waldeck; **Pittsburgh Coal**; elevation, 910' B.

			Ft.	In.
Shale, brownish-gray, siliceous, visible			25	0
Coal	0'	11"		
Coal, slaty	0	4		
Coal	3	0	4	3
Fire clay shale			5	0
Concealed			10	0
Sandstone, massive			15	0
Concealed to run, mostly sandstone			20	0

J. H. Leaseburg Coal Opening—No. 117 on Map II.

On south hillside of Bull Run, 1.2 miles southeast of Waldeck; **Pittsburgh Coal**; elevation, 975' B.

			Ft.	In.
Shale, dark, siliceous, visible			5	0
Coal	0'	9½"		
Bone **coal**	0	2½		
Coal, medium-hard, good (shale floor)	2	6	3	6

W. H. Bosley Coal Exposure—No. 118 on Map II.

Outcrop in branch of Bull Run, 1.0 mile east of Opening No. 116 above; **Pittsburgh Coal**; elevation, 990' B.

			Ft.	In.
Shale, dark, siliceous, visible			2	0
Coal, visible	0'	8"		
Coal, concealed, **reported**	1	2	1	10

John Smith Coal Prospect—No. 119 on Map II.

On Bull Run, 2.0 miles southeast of Waldeck; **Pittsburgh Coal**; elevation, 985' B.; closed, **reported** 1' 0" thick.

The 15 following prospect openings and country banks, all located on the waters of Cedar Creek, in Otter District, Braxton County, were examined by Gawthrop:

Ralph Bennett Local Mine—No. 120 on Map II.

On east bank of Cedar Creek, just east of Braxton-Gilmer County Line; **Pittsburgh Coal**; elevation, 810' B.

		Ft.	In.
Shale, dark, visible		8	0
Coal, hard, good	1' 10"		
Bone, 2" to	0 0		
Coal, hard, good (shale floor)	2 2	4	0

A. L. Jack Coal Opening—No. 121 on Map II.

On west bank of Cedar Creek, 0.6 mile southeast of Braxton-Gilmer County Line; **Pittsburgh Coal**; elevation, 860' B.; closed, reported 1' 0" thick at entrance and increasing to 3' 0".

Luther Gerwig Coal Opening—No. 122 on Map II.

On branch of Toms Run, 1¼ miles northeast of Hope; **Pittsburgh Coal**; elevation, 920' B.

	Ft.	In.
Coal (with shale roof) about	3	0
Concealed	35	0
Sandstone, **Lower Pittsburgh**	10	0

A. J. Gerwig Coal Opening—No. 123 on Map II.

On branch of Toms Run, 0.9 mile south 10° east of Opening No. 122 above; **Pittsburgh Coal**; elevation, 1005' B.

		Ft.	In.
Sandstone, visible		10	0
Shale, dark		10	0
Coal, medium-hard	1' 8"		
Coal, bony	0 3		
Coal, hard, good	3 0	4	11
Fire clay shale and concealed		65	0
Sandstone, coarse, pebbly, **Connellsville**, visible		35	0

"Mr. Gerwig reports that the coal was very irregular, and thinned down in many places."

Coal Prospect No. 124 on Map II, located on a branch of Toms Run, 1.0 mile S. 40° E. of Hope, at an elevation of 965′ B., was closed when visited by Gawthrop, and the thickness of the **Pittsburgh Coal** at this point was not learned.

G. F. Gerwig Coal Opening—No. 125 on Map II.

On south bank of Toms Run, ½ mile east of Hope; **Pittsburgh Coal**; elevation, 935′ B.; about 5 feet above water-level; **reported** by Mr. Gerwig 1′ 1″ thick.

W. R. Moyers Coal Opening—No. 126 on Map II.

On west side of Trace Run, opposite mouth of Little Trace Run; **Pittsburgh Coal**; elevation, 1015′ B.

			Ft.	In.
Shale, siliceous, gray, visible			5	0
Coal	0′	11″		
Bone	0	3		
Coal	1	2		
Shale, dark, 0″ to	0	1		
Coal	0	3		
Shale, black, 4″ to	0	2		
Coal, medium-hard, good (shale floor)	1	10	4	8

Andrew Belknap Coal Opening—No. 127 on Map II.

On west side of Trace Run, ¾ mile southwest of Little Trace Run; **Pittsburgh Coal**; elevation, 1010′ B.; closed.

Henry Belknap Coal Opening—No. 128 on Map II.

On east hillside of Trace Run, 2.33 miles southwest of Cutlips; **Pittsburgh Coal**; elevation, 1080′ B.

	Ft.	In.
Shale, gray		
Coal (to shale floor)	1	10

J. M. Gerwig Coal Opening—No. 129 on Map II.

On east hillside of Trace Run, 0.3 mile southeast of Opening No. 128 above; **Pittsburgh Coal**; elevation, 1100′ B.

	Ft.	In.
Concealed		
Coal, reported by Mr. Gerwig from 2′ 0″ to	4	0
Concealed	35	0
Sandstone, massive, coarse, gray, pebbly, visible	15	0

Reuben Gerwig Coal Opening—No. 130 on Map II.

On east hillside of Little Trace Run, 1 mile N. 85° W. of Cutlips; **Pittsburgh Coal**; elevation, 1075′ B.

			Ft.	In.
Coal, hard (gray shale roof)	2′	6″		
Shale, dark, 0′ 8″ to	0	0		
Coal, hard	1	7	4	1
Shale and concealed			15	0
Sandstone, massive, medium-grained, micaceous			25	0
Concealed			35	0
Sandstone, massive, coarse, brownish-gray, **Connellsville**			15	0

E. W. Cutlip Coal Opening—No. 131 on Map II.

On east hillside of Cedar Creek, 0.2 mile north of Cutlips; **Pittsburgh Coal**; elevation, 1050′ B.; closed, reported 3′ 6″ to 4′ 0″ thick.

M. J. Cutlip Heirs Coal Opening—No. 132 on Map II.

On point, ⅛ mile southeast of Cutlips; **Pittsburgh Coal**; elevation, 1060′ B.

			Ft.	In.
Sandstone, shaly			5	0
Shale, bluish-gray			10	0
Coal, medium-hard	2′	0″		
Bone	0	4		
Coal, hard, good	3	6		
Coal, concealed by water	1	0	6	10

W. O. Priest Coal Prospect—No. 133 on Map II.

On south hillside of Brush Run, 1.0 mile northeast of Cutlips; **Pittsburgh Coal**; elevation, 1030′ B.; closed, reported 1′ 6″ thick.

T. A. Cutlip Coal Opening—No. 134 on Map II.

On south bank of Slabcamp Run, at Braxton; **Pittsburgh Coal**; elevation, 1045′ B.

			Ft.	In.
Shale, gray, visible			5	0
Coal, medium-soft	2′	0″		
Bone coal, 0′ 10″ to	0	6		
Coal, hard, good (shale floor)	4	0	6	6

The following data were obtained at a commercial mine in Otter District, on waters of Cedar Creek:

Gilmer and Braxton Consolidated Coal Co.—Braxton Mine—No. 135 on Map II.

On south bank of Slabcamp Run, just southwest of Braxton; Pittsburgh Coal; elevation, 1045' B.; coal owned by Louis Bennett.

			Ft.	In.
Shale, gray, visible			5	0
Coal	2'	9"		
Bone coal	0	4		
Coal (shale floor)	3	11	7	0

The above mine was not in operation when visited by Gawthrop in October, 1915.

In the same District, on the waters of Cedar Creek, the 12 following openings were examined by Gawthrop:

T. A. Cutlip Coal Opening—No. 136 on Map II.

On south bank of Slabcamp Run, 0.4 mile east of Braxton; Pittsburgh Coal; elevation, 1060' B.; closed, reported by Mr. Cutlip 5' 0" thick.

M. K. Perrine Coal Opening—No. 137 on Map II.

On east hillside of Right Fork, 1.5 miles due east of Cutlips; Pittsburgh Coal; elevation, 1080' B.; closed, reported 4' 0" to 9' 0" thick.

J. W. Dean Coal Opening—No. 138 on Map II.

On west hillside of Right Fork, 0.9 mile southwest of Opening No. 137 above; Pittsburgh Coal; elevation, 1125' B.

	Ft.	In.
Shale, gray, visible	5	0
Coal, medium-soft	2	3
Shale and concealed	65	0
Sandstone, Connellsville, massive, coarse-grained, brownish-gray, pebbly	10	0

J. W. Bosley Coal Opening—No. 139 on Map II.

On north hillside of Cedar Creek, ¾ mile northeast of mouth of Perkins Fork; **Pittsburgh Coal**; butts, N. 70° W.; faces, N. 20° E.; elevation, 1055′ B.

			Ft.	In.
Shale, dark, visible			10	0
Coal, medium-hard	1′	8″		
Bone **coal**	0	4		
Coal, harder	2	4	4	4
Fire clay shale and concealed			65	0
Sandstone, **Connellsville**			30	0

M. A. Lloyd Coal Opening—No. 140 on Map II.

On south side of Cedar Creek, ¾ mile southeast of Opening No. 139 above; **Pittsburgh Coal**; elevation, 1060′ B.

			Ft.	In.
Sandstone, flaggy, visible			2	0
Shale, dark, argillaceous			2	0
Coal, bony	0′	6″		
Coal	0	6		
Bone **coal**	0	2		
Coal (to fire clay shale floor)	2	9	3	11

C. H. Bosley Coal Opening—No. 141 on Map II.

On south hillside of branch of Cedar Creek, ⅛ mile northeast of mouth of Westfall Fork; **Pittsburgh Coal**; elevation, 1085′ B.; closed, thinned down and almost disappeared when driven in, but on crop reported 5′ 0″ thick.

J. L. Lloyd Coal Prospect—No. 142 on Map II.

On west hillside of Shaver Fork, 0.4 mile northwest of Lloydsville; **Pittsburgh Coal**; elevation, 1150′ B.; prospect closed.

Wesley Lloyd Coal Prospect—No. 143 on Map II.

On south hillside of Shaver Fork, 2.4 miles southeast of Cutlips; **Pittsburgh Coal**; elevation, 1105′ B.; closed, reported about 3′ 0″ thick.

Henry Gerwig Coal Opening—No. 144 on Map II.

On south hillside of Shaver Fork, 2.0 miles southeast of Cutlips; Pittsburgh Coal; elevation, 1085' B.

	Ft.	In.
Sandstone, massive, visible	5	0
Shale and concealed	5	0
Coal, concealed, reported 2' 0" to	4	0
Concealed	50	0
Sandstone, massive, gray, coarse-grained, pebbly, Lower Pittsburgh	40	0
Concealed	55	0
Sandstone, flaggy and massive	15	0

S. T. Perrine Coal Prospect—No. 145 on Map II.

On west hillside of Perkins Fork, 1.5 miles southeast of Cutlips; Pittsburgh Coal; elevation, 1065' B.; closed; did not get in to roof to determine true thickness; on crop, reported 2' 0" thick.

A. T. Petry Coal Opening—No. 146 on Map II.

One-fourth mile up Venison Fork of Perkins Fork, on north hillside; Pittsburgh Coal; elevation, 1100' B.

			Ft.	In.
Sandstone			5	0
Shale, gray			10	0
Coal, medium-hard	2'	3"		
Bone	0	1		
Coal, medium-hard, good	3	2		
Sulphur band	0	4		
Coal, medium-hard (shale floor)	1	0	6	10

Coal Prospect—No. 147 on Map II.

0.7 mile up Venison Fork of Perkins Fork, on north hillside; Pittsburgh Coal; elevation, 1100' B.; prospect closed; only a little coal found.

The nine following prospects and country banks in the Pittsburgh bed, on the waters of Left Fork of Steer Creek in Otter District, were also examined by Gawthrop:

I. T. White Coal Prospect—No. 148 on Map II.

On west bank of Bender Run, 1.3 miles northwest of German; Pittsburgh Coal; elevation, 915' B.; closed; only a few inches found.

Henry Gerwig Coal Opening—No. 149 on Map II.

On branch of Left Fork of Steer Creek, 1.0 mile northeast of German; Pittsburgh Coal; elevation, 960′ B.; closed, reported 2′ 8″ to 3′ 0″ thick.

C. L. Engel Coal Opening—No. 150 on Map II.

On west hillside of Granddaddy Run, 0.4 mile southwest of German; Pittsburgh Coal; "coal is irregular; section varies at different locations"; elevation, 1005′ B.

	Ft.	In.
Coal, hard (shale roof)	3	9
Fire clay shale, soft	0	6
Shale, dark	2	0
Concealed	48	0
Sandstone, Lower Pittsburgh, massive, pebbly, visible	15	0

Mrs. T. S. Gerwig Coal Opening—No. 151 on Map II.

On west hillside of Left Fork, 0.7 mile west of Chapel; Pittsburgh Coal; elevation, 1130′ B.

	Ft.	In.
Concealed		
Coal, concealed, reported by Mrs. Gerwig	2	0
Concealed	60	0
Sandstone, massive, coarse, pebbly, Lower Pittsburgh	25	0

U. B. Parsonage Coal Opening—No. 152 on Map II.

On northeast side of Brady Fork, 0.6 mile northwest of Home P. O.; Pittsburgh Coal; elevation, 1150′ B.

	Ft.	In.
Shale, brown, siliceous, visible	15	0
Shale, bluish-gray	5	0
Coal, concealed, reported	2	6
Shale and concealed		

D. H. Baker Coal Opening—No. 153 on Map II.

On east hillside of Grasslick Run, 0.8 mile southeast of Opening No. 151 above; Pittsburgh Coal; elevation, 1185′ B.

	Ft.	In.
Concealed		
Coal, concealed, reported by Mr. Baker	1	10
Concealed to bench	35	0

Henry Bender Coal Opening—No. 154 on Map II.

On west hillside of Straight Fork, 1.4 miles south of Chapel; **Pittsburgh Coal**; elevation, 1220' B.; section as reported by native.

			Ft.	In.
Coal, medium-hard (shale roof)	1'	6"		
Bone, 0' 3" to	0	0		
Coal, hard	1	2		
Coal, soft (to shale)	0	10	3	6

F. S. Stewart Coal Prospect—No. 155 on Map II.

On a west branch of Left Fork, 2.75 miles due north of Gassaway; **Pittsburgh Coal**; elevation, 1190' B.; closed, not in to solid roof; on crop, reported 1' 10" thick.

I. M. Perkins Coal Opening—No. 156 on Map II.

On west hillside of Left Fork, 1.2 miles southeast of Chapel; **Pittsburgh Coal**; elevation, 1175' B.

	Ft.	In.
Coal, medium-hard (shale roof), 2' 0" to	4	0
Fire clay shale and concealed		

The two following diggings in Otter District on the waters of Crooked Fork were examined by Gawthrop:

Coal Prospect—No. 157 on Map II.

On north bank of Crooked Fork, just east of Gilmer-Braxton County Line; **Pittsburgh Coal**; elevation, 900' B.

	Ft.	In.
Sandstone, massive, visible	10	0
Concealed	10	0
Coal, reported to be about	1	6
Concealed	50	0
Sandstone, **Lower Pittsburgh**	10	0

James Cole Coal Opening—No. 158 on Map II.

On south bank of Crooked Fork, 0.8 mile southeast of Progress; **Pittsburgh Coal**; elevation, 955' B.

	Ft.	In.
Coal, opening closed, reported	1	6
Concealed to run	10	0

In the same District (Otter), on the waters of O'Brien Fork of Steer Creek, the three following country banks in the Pittsburgh seam were examined by the writer:

Stephen Stonestreet Coal Opening—No. 159 on Map II.

On south hillside of Triplett Fork of O'Brien Fork of Steer Creek, 1.0 mile northwest of Davison; **Pittsburgh Coal**; elevation, 950' B.; closed, **reported** 1' 6" thick.

Wm. A. Marlow Coal Opening—No. 160 on Map II.

On head of Limestone Run, 2.3 miles northeast of Belfont; **Pittsburgh Coal**; elevation, 1240' B.; closed, **reported** 2' 6" thick.

Samuel Skidmore Coal Opening—No. 161 on Map II.

On head of Bills Fork, 2.2 miles northeast of Belfont; **Pittsburgh Coal**; elevation, 1360' B.

	Ft.	In.
Coal (could not determine thickness on account of water) **reported**	2	6

On the same waters and in the same District, the 4 following diggings in the Pittsburgh bed were examined by Gawthrop:

H. B. Starkey Coal Opening—No. 162 on Map II.

On west hillside of Limestone Run, 0.6 mile northeast of Belfont; **Pittsburgh Coal**; butts, N. 80° W.; faces, N. 10° E.; elevation, 1185' B.

				Ft.	In.
1.	Shale				
2.	**Coal**, medium-hard	0'	9"		
3.	Bone coal	0	2		
4.	**Coal**, hard, splinty	2	4		
5.	**Coal**, medium-hard	1	6	4	9
6.	Shale and concealed				

The analysis of a sample (165Ga) collected from Nos. 2 and 5 of above section, and the analysis of a sample (165Gb) from No. 4 of section are published under **No. 162** in the table of coal analyses at the end of this Chapter.

O. N. Meadows Coal Opening—No. 163 on Map II.

On west hillside of Wolfpen Run, 0.6 mile southeast of Belfont; **Pittsburgh Coal**; elevation, 1240′ B.

			Ft.	In.
Coal, medium-hard, visible	1′	6″		
Coal, slaty, 0″ to	0	2		
Coal, hard	2	0		
Coal, softer (shale floor)	1	0	4	8

Huston Rollyson Coal Opening—No. 164 on Map II.

On north hillside of Plantation Fork, 1.3 miles southeast of Belfont; **Pittsburgh Coal**; elevation, 1285′ B.

			Ft.	In.
Coal, medium-hard (shale roof)	1′	2″		
Bone	0	2		
Coal, hard	2	6		
Coal, softer (shale floor)	1	0	4	10

The **R. M. Carr Coal Opening—No. 165 on Map II**—located on the west hillside of Plantation Fork, 1.6 miles S. 5° W. of Belfont; **Pittsburgh Coal**; elevation, 1210′ B., was closed when visited by Gawthrop and no measurement could be obtained.

The following opening on Sugarcamp Run in Otter District, Braxton County, was examined by writer:

Samuel Skidmore Coal Opening—No. 166 on Map II.

On north edge of road, 0.9 mile N. 35° W. of Clickton; **Pittsburgh Coal**; elevation, 1495′ B.; closed, **reported** 2′ 6″ to 3′ 0″ thick.

In the same District and on the same waters, the two following openings were examined by Gawthrop:

John Cole Coal Opening—No. 167 on Map II.

On east hillside of Sugarcamp Run, ¼ mile due east of Clickton; **Pittsburgh Coal**; elevation, 1455′ B.

				Ft.	In.
1.	Shale				
2.	**Coal**, medium-hard, good	1′	0″		
3	**Coal**, hard, gray	0	3		
4.	**Coal**, hard, good	2	0		
5.	**Coal**, softer, good	0	7	3	10
6.	Shale and concealed				

The analysis of a sample (163G) collected from Nos. 2, 4, and 5 of above section, as reported by Messrs. Hite and Krak, is given under **No. 167** in the table of coal analyses at the end of this Chapter.

J. F. Davis Coal Opening—No. 168 on Map II.

On south side of knob, 1.5 miles S. 40° E. of Clickton; **Pittsburgh Coal**; elevation, 1450′ B.

			Ft.	In.
Coal (shale roof)	1′	0″		
Bone coal	0	2		
Coal, hard, good	2	7		
Coal, soft (shale floor)	0	10	4	7

Coal Exposure No. 169 on Map II, in the Pittsburgh Coal. on north edge of hill road, 0.2 mile southeast of Sugar Knob. at an elevation of 1395′ B., is shown in the Sugar Knob Section, page 64.

On the waters of Little Otter Creek, the four following country banks on the Pittsburgh bed were examined by Gawthrop:

A. N. Lough Coal Opening—No. 170 on Map II.

On east hillside of Brushy Fork, 1.8 miles N. 80°-85° E. of Sugar Knob; **Pittsburgh Coal**; elevation, 1205′ B.

			Ft.	In.
Shale, visible			5	0
Coal, medium-soft	2′	4″		
Coal, bony	0	3		
Coal, hard, good	3	3		
Coal, soft (shale floor)	1	2	7	0

D. H. Baker Coal Opening—No. 171 on Map II.

On east hillside of Brushy Fork, 1.4 miles due east of Sugar Knob; **Pittsburgh Coal**; elevation, 1210′ B.

	Ft.	In.
Coal, opening closed, **reported** 6′ 0″ to	8	0

H. M. Helmick Coal Opening—No. 172 on Map II.

On south hillside of Little Otter Creek, 1.6 miles northwest of Sutton Station (B. & O.); **Pittsburgh Coal**; elevation, 1325′ B; closed, **reported** to run from 1′ 0″ to 5′ 0″ thick.

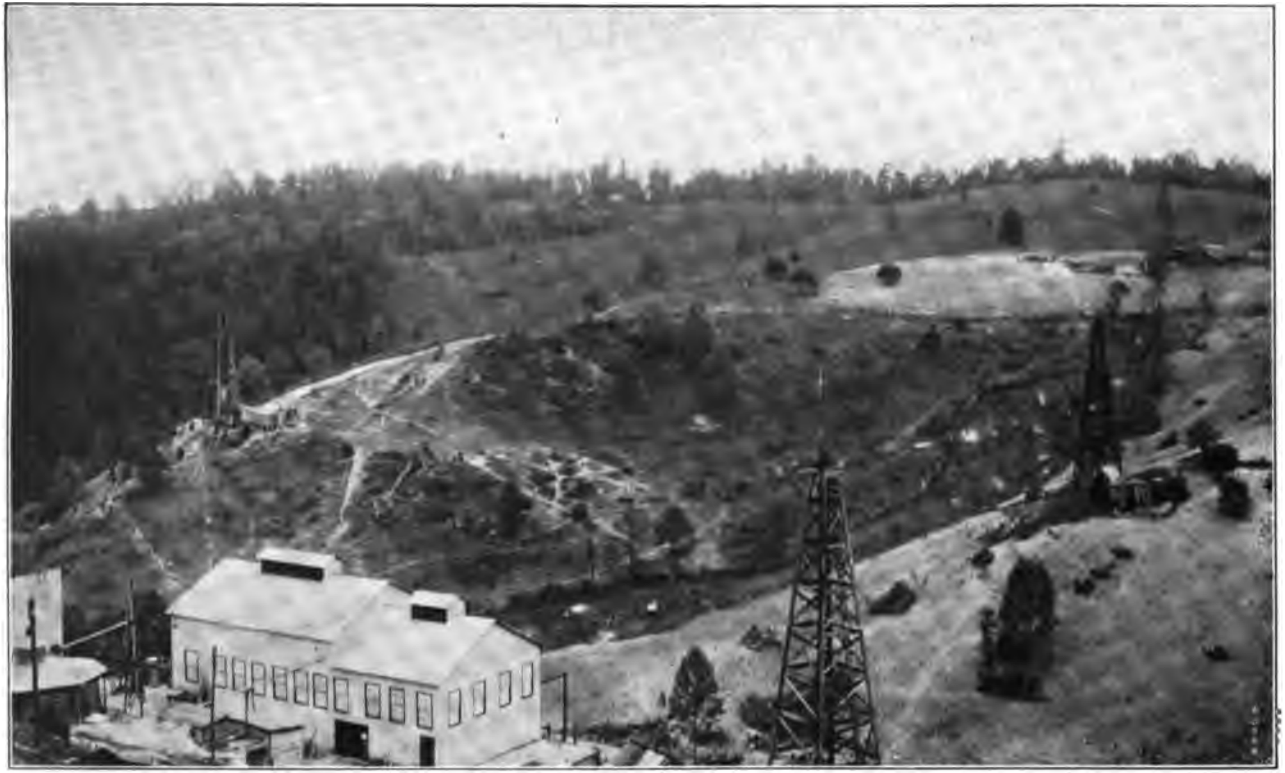

PLATE XIX.—Showing oil wells in Big Injun Sand pool about a mile east of Bomont, Clay County; topography of Conemaugh and Allegheny Series.

Robert Rader Heirs Coal Opening—No. 173 on Map II.

On west hillside of Walnut Fork, 1.4 miles due north of Gassaway. **Pittsburgh Coal**; elevation, 1225′ B.

	Ft.	In.
Sandstone, visible	5	0
Shale	5	0
Coal, concealed, reported 4′ 0″ to	6	0

A few isolated areas of Pittsburgh Coal near the summits of high knobs occur on the south side of Elk River in Otter District (Braxton), the following opening being examined by Gawthrop:

E. B. Duckworth Coal Opening—No. 174 on Map II.

On west side of knob, 1.1 miles N. 30°-35° W. of Coon Knob; **Pittsburgh Coal**; elevation, 1610′ B.; opening closed.

In this same region, the two following openings were examined by Gawthrop and the writer:

T. M. Coulter Coal Opening—No. 175 on Map II.

On southeast side of knob, ¾ mile N. 60° W. of Coon Knob; **Pittsburgh Coal**; elevation, 1620′ B.

			Ft.	In.
Concealed from top of knob, estimated			75	0
Shale				
Coal, medium-hard	2′	8″		
Bone	0	2		
Coal, hard	3	0		
Coal, softer (shale floor)	1	2	7	0

A sample for analysis was collected at the above opening by I. C. White and the writer, and the results, as published on pages 666-7 of Volume II(A) of the State Survey Reports, are given under No. 175 in the table of coal analyses at the end of this Chapter.

Houston H. Davis Coal Opening—No. 176 on Map II.

On summit of knob, 1.3 miles S. 87° E. of Coon Knob; **Pittsburgh Coal**; elevation, 1710′ L.; closed, bed apparently 3 to 4 feet in thickness, and belongs about 5 feet below 5 to 6 feet of dark-gray and pure limestone (**Redstone**) exposed here at outcrop.

Birch District, Braxton County.

In Birch, the stratigraphic position of the Pittsburgh Coa is shown in the sections in Chapter IV for Rosedale, 1.1 Miles North of Dessie, and Frametown—Eli Taylor Knob, on pages 76-7, 80, and 81-2, respectively. No commercial mines occur on it, but as in Salt Lick and Otter, it has been prospected extensively by natives for local domestic fuel. The two following openings were examined by D. B. Reger in gathering data for the Lewis-Gilmer County Report:

Coal Opening—No. 177 on Map II.

On west hillside of Mill Fork, 1.7 miles southwest of Rosedale; **Pittsburgh Coal**; elevation, 1010′ B.; section by Reger.

Coal, opening closed and abandoned; thickness not learned.

Coal Opening—No. 178 on Map II.

On west hillside of Mill Fork, 2.5 miles southwest of Rosedale; **Pittsburgh Coal**; elevation, 1055′ B.; section by Reger.

	Ft.	In.
Sandstone		
Shale, sandy	5	0
Coal, slaty at top, 2′ 0″ to	3	0
Slate pavement		

The 10 following openings in the same District on the waters of Left Fork of West Fork River were examined by the writer:

Jerry H. King Coal Opening—No. 179 on Map II.

On south hillside, 0.33 mile northwest of Teeny Knob; **Pittsburgh Coal**; elevation, 1110′ B.; closed; reported by Mr. King 2′ 8″ to 3′ 0″ thick.

William Tucker Coal Opening—No. 180 on Map II.

On south hillside, 0.3 mile south of Teeny Knob; **Pittsburgh Coal**; elevation, 1120' B.

				Ft.	In.
1.	Sandstone roof, bluish				
2.	Coal, block, hard	2'	0"		
3.	Slate, sandy	0	1		
4.	Coal, curly, hard	2	2	4	3
5.	Slate floor				

The above section was 50 to 60 feet in the mine. At 100 feet in, only about 2 feet of coal of the lower bench is found, the upper bench being cut out. The analysis of a sample (892H) collected by the writer from Nos. 2 and 4 of above section, as reported by Messrs. Hite and Krak, is given under No. 180 in the table of coal analyses at the end of this Chapter.

Parkersburg Mill Co. Coal Opening—No. 181 on Map II.

On east hillside, 0.9 mile N. 10° E. of Rattlesnake Knob; **Pittsburgh Coal**; elevation, 1145' B.

			Ft.	In.
Coal, visible	1'	5"		
Slate, coaly	0	1		
Coal, semi-splint (slate floor)	2	6	4	0

Upton See Coal Opening—No. 182 on Map II.

On south hillside, 0.5 mile due north of Rattlesnake Knob; **Pittsburgh Coal**; butts, N. 85° W.; faces, N. 5° E.; elevation, 1145' B.

			Ft.	In.
Shale roof, soft				
Coal, hard, bright	0'	11"		
Bone coal	0	2		
Coal, hard, bright	1	6		
Bone coal	0	1		
Coal, hard, bright (slate floor)	2	4	5	0

At one point in the above mine, a "horseback" or clay seam cuts the coal out entirely. Mr. See sells the coal at 6 cents per bushel at the mine and pays the owner 1 cent a bushel royalty. Last year he mined about 2,000 bushels.

Oscar Chenoweth Coal Opening—No. 183 on Map II.

On east hillside of Left Fork, 0.4 mile due west of Rattlesnake Knob; **Pittsburgh Coal**; elevation, 1150′ B.

			Ft.	In.
Coal, hard (shale roof)	1′	2″		
Bone	0	6		
Coal, hard	1	0		
Slate, black, coaly	0	1		
Coal, hard (gray slate floor)	2	4	5	1

Gratney Wright Coal Opening—No. 184 on Map II.

On north side of run, 0.7 mile N. 15° E. of Elmira; **Pittsburgh Coal**; elevation, 1165′ B.

			Ft.	In.
Shale, sandy, roof				
Coal, medium-hard	2′	7″		
Slate, coaly	0	1		
Coal, medium-hard (slate floor)	2	4	5	0

The bed is somewhat irregular in thickness. At a point or two in this opening, it is reported to attain a thickness of 7 feet. This bank furnishes a large supply of domestic fuel for the community.

R. F. Barr Coal Opening—No. 185 on Map II.

On east hillside of Left Fork, 0.4 mile north of Elmira; **Pittsburgh Coal**; elevation, 1155′ B.; closed, reported by Worth Barr to run between 4′ 0″ and 7′ 0″ thick.

This is the oldest coal bank in this neighborhood, a large amount of domestic fuel having been mined here. This digging belongs 75 feet directly above another—No. 7 on Map II—in the Little Pittsburgh Coal, the details of which are given in Chapter VI, page 188.

Samuel Gibson Coal Opening—No. 186 on Map II.

On west hillside, 0.6 mile southwest of Elmira; **Pittsburgh Coal**; elevation, 1160′ B.; closed, reported 3′ 6″ to 4′ 0″ thick.

Samuel Morris Coal Opening—No. 187 on Map II.

On head of branch, 0.8 mile south of Elmira; **Pittsburgh Coal**; elevation, 1180′ B.

			Ft.	In.
Sandstone, massive, coarse			6	0
Coal, medium-hard	1′	0″		
Slate, coaly	0	1		
Coal (shale floor)	2	3	3	4

David J. Hall Coal Opening—No. 188 on Map II.

On north side of hill road, 1.0 mile southeast of Elmira; **Pittsburgh Coal**; elevation, 1215′ B.

			Ft.	In.
Shale, argillaceous, soft, roof				
Coal, bright, block	0′	10″		
Slate, coaly, ⅛″ to	0	1		
Coal, semi-splint (slate floor)	2	3	3	2

The 6 following openings in Birch District, on the waters of Sleith Fork, were examined by the writer:

William Ramsey Coal Opening—No. 189 on Map II.

On west hillside of Sleith Fork, 0.33 mile northwest of Sleith; **Pittsburgh Coal**; elevation, 1150′ B.; closed reported by Charles Ramsey to be 3′ 0″ to 3′ 6″ thick.

Garfield McCumbers Coal Prospect—No. 190 on Map II.

On branch of Cowskin Fork, 1.3 miles S. 45° W. of Sleith; **Pittsburgh Coal**; elevation, 1170′ B.; closed, coal on dump, but never mined.

Coal Opening—No. 191 on Map II.

On branch of Cowskin Fork, 1.3 miles S. 45° W. of Sleith; **Pitts-Pittsburgh Coal**; elevation, 1165′ B.; closed, reported 3′ 0″ to 4′ 0″ thick.

Andrew White Coal Opening—No. 192 on Map II.

On south hillside, 0.4 mile up Boggs Fork of Sleith Fork; **Pittsburgh Coal**; elevation, 1165′ B.; closed, reported, 0′ 3″ to 0′ 6″ thick.

E. H. Frame Coal Opening—No. 193 on Map II.

On south hillside, 1.0 mile S. 30° E. of Opening No. 192 above; **Pittsburgh Coal**; elevation, 1245' B.

			Ft.	In.
Shale, visible			3	0
Coal	1'	0"		
Slate, with **coal** streak	0	3		
Coal, semi-splint (slate floor)	2	6	3	9

A clay seam at one point in the above mine has almost entirely cut out the coal. The digging is driven in only 30 to 40 feet.

Houston Young Coal Opening—No. 194 on Map II.

On north hillside of Sleith Fork, 1.5 miles southwest of Dessie; **Pittsburgh Coal**; elevation, 1215' B.; section by A. Rollyson; opening closed.

			Ft.	In.
Coal, 6" to	0'	8"		
Slate, black	0	1		
Coal, 7" to	1	0		
Slate, black	0	1		
Coal	2	0		
Slate, blue, hard	0	4		
Coal	2	6	6	8

No blossom of the Pittsburgh Coal has ever been found at the outcrop of its horizon on Upper Sleith Fork.

The data on the 5 following openings in Birch District, on the waters of Duck Creek, were obtained by the writer:

Allen Rose Coal Opening—No. 195 on Map II.

On east hillside of Duck Creek, 1.0 mile N. 15°-20° E. of Servia; **Pittsburgh Coal**; elevation, 1225' B.; hand-leveled across from Opening No. 196 below for elevation; thickness not learned.

Coal Opening—No. 196 on Map II.

On west hillside of Duck Creek, 1¼ miles due north of Servia; **Pittsburgh Coal**; elevation, 1205' B.; closed; thickness could not be determined.

S. Davis Coal Opening—No. 197 on Map II.

On west hillside of Duck Creek, 0.7 mile S. 10° W. of Servia; **Pittsburgh Coal**; elevation, 1320′ B.

			Ft.	In.
Shale, dark-gray, visible			6	0
Coal, bony	0′	4″		
Coal	0	4		
Shale, dark-gray	0	4		
Coal	0	8		
Slate, coaly	0	3		
Coal, semi-splint	1	7	3	6
Coal, concealed by water				

C. B. Case Coal Opening—No. 198 on Map II.

On branch of Laurel Fork of Duck Creek, 0.8 mile S. 10° W. of Servia; **Pittsburgh Coal**; elevation, 1335′ B.

			Ft.	In.
Shale roof, soft, visible			1	0
Coal, blocky	0′	4″		
Shale, dark	0	2		
Coal, blocky, bright	0	8		
Slate, black, coal streaks	0	3		
Coal, semi-splint	1	7		
Coal, softer (slate floor)	1	0	4	0

N. H. Mollohan Coal Opening—No. 199 on Map II.

On northeast side of knob, 1.2 miles S. 70° E. of Servia; **Pittsburgh Coal**; elevation, 1375′ B.; closed; thickness could not be determined, but judging from props should be from 3′ 0″ to 4′ 0″.

In the same District (Birch), the following opening was examined by Gawthrop:

N. H. Mollohan Coal Opening—No. 200 on Map II.

On head of Tate Creek, 0.3 mile southeast of Opening No. 199; **Pittsburgh Coal**; elevation, 1395′ B.

			Ft.	In.
Coal (shale roof)	0′	7″		
Slate	0	3		
Coal	0	5		
Slate	0	2		
Coal, hard	1	4		
Coal, softer (slate floor)	1	0	3	9

The data on the two following openings in Birch District were obtained by the writer:

R. F. Chapman Coal Opening—No. 201 on Map II.

On north edge of road, 1.5 miles N. 70° E. of Servia; **Pittsburgh Coal**; elevation, 1305' B.

			Ft.	In.
Coal, bright	0'	4"		
Slate, dark	0	2		
Coal, bright	0	7		
Bone	0	3		
Coal, bright	1	0		
Coal, slaty	0	3		
Coal, semi-splint (slate floor)	2	3	4	10

Hart Brothers Coal Opening—No. 202 on Map II.

Just north of road fork, 1.4 miles S. 10° W. of Dessie; **Pittsburgh Coal**; elevation, 1240' B.

			Ft.	In.
Coal (slate roof)	0'	7"		
Bony slate	0	5		
Coal	1	6		
Coaly slate	0	2		
Coal, semi-splint (slate floor)	2	6	5	2

The 5 following openings in the same District were examined by Gawthrop:

David Hamric Coal Opening—No. 203 on Map II.

On south side of ridge, 0.8 mile due north of Tate; **Pittsburgh Coal**; elevation, 1320' B.; closed; thickness not learned.

R. J. Gum Coal Opening—No. 204 on Map II.

On east side of ridge, 1.0 mile N. 20° E. of Tate; **Pittsburgh Coal**; elevation, 1360' B.; closed, reported 4' 6" thick.

R. S. Ramsey Coal Opening—No. 205 on Map II.

On east hillside of Plantation Fork, 1.0 mile southeast of Dessie; **Pittsburgh Coal**; elevation, 1235′ B.

			Ft.	In.
Coal, medium-hard (shale roof)	1′	1″		
Bone	0	2		
Coal, medium-hard	1	1		
Slate, coaly	0	4		
Coal, hard	1	6		
Coal, softer (shale floor)	1	0	5	2

Thomas White Coal Opening—No. 206 on Map II.

1.0 mile S. 20° W. of Dessie; **Pittsburgh Coal**; elevation, 1195′ B.

			Ft.	In.
Coal, roof, reported (shale roof)	1′	6″		
Coal	0	6		
Bone	0	2		
Coal, medium-hard	1	2		
Slate, coaly	0	2		
Coal, hard (shale floor)	2	6	6	0

William Wilson Coal Opening—No. 207 on Map II.

One mile S. 40° W. of Dessie; **Pittsburgh Coal**; butts, N. 75° W.; faces, N. 15° E.; elevation, 1190′ B.

			Ft.	In.
Shale, visible			2	0
Coal, slaty	0′	3″		
Coal, medium-hard	1	3		
Bone	0	3		
Coal, hard (slate floor)	2	4	4	1

The section of the **Boggs Coal Opening—No. 208 on Map II**—located on the east side of Eli Taylor Knob, 0.8 mile northwest of Frametown, in the Pittsburgh Coal, at an elevation of 1390′ B., is published in Chapter IV, page 82, in the Frametown-Eli Taylor Knob Section.

The data in the 7 following openings in the northeast border of Birch District, Braxton County, were obtained by Gawthrop:

V. B. Frame Coal Opening—No. 209 on Map II.

0.8 mile north of Eli Taylor Knob; **Pittsburgh Coal**; elevation, 1340′ B.

			Ft.	In.
Coal, medium-hard (shale roof)	1′	0″		
Slate, 0½″ to	0	0		
Coal, hard	1	10		
Coal, softer (shale floor)	1	0	3	10

J. W. Keener Coal Opening—No. 210 on Map II.

1.0 mile N. 20° W. of Eli Taylor Knob; **Pittsburgh Coal**; elevation, 1285′ B.

			Ft.	In.
Coal, medium-hard (shale roof)	1′	2″		
Slate	0	2		
Coal, hard	1	2		
Coal, softer (shale floor)	1	0	3	6

Mrs. Eulan Young Coal Opening—No. 211 on Map II.

On head of Big Run, 1.75 miles N. 10°-15° W. of Frametown; **Pittsburgh Coal**; elevation, 1320′ B.

	Ft.	In.
Shale, visible	5	0
Coal, varies from 2′ 0″ to (shale floor)	4	6

Perry Meadows Coal Opening—No. 212 on Map II.

On head of Frame Fork, 2.8 miles N. 5° E. of Frametown; **Pittsburgh Coal**; elevation, 1340′ B.; closed; **reported** 4′ 0″ (with 0′ 4″ slate two-thirds distance from bottom) to 7′ 0″ thick.

C. E. Carr Coal Opening—No. 213 on Map II.

On north side of Frame Fork, 2.8 miles N. 5° W. of Frametown; **Pittsburgh Coal**; elevation, 1240′ B.

			Ft.	In.
Coal, medium-hard (shale roof)	0′	10″		
Coal, hard, splinty	1	10		
Coal, softer	0	10	3	6
Shale and concealed			30	0
Sandstone			25	0

W. J. Belknap Coal Opening—No. 214 on Map II.

¼ mile north of Opening No. 213 above; **Pittsburgh Coal**; elevation, 1205′ B.

			Ft.	In.
Coal, medium-hard (shale roof)	1′	0″		
Coal, hard	1	7		
Coal, softer (shale floor)	1	0	3	7

Ida F. Queen Coal Opening—No. 215 on Map II.

On south bank of Tague Fork, 1.7 miles due west of Belfont; **Pittsburgh Coal**; elevation, 930′ B.; closed; no coal visible, **reported** 2′ 0″ thick.

Otter District, Clay County.

In Otter District, Clay County, the **Pittsburgh Coal** bed is confined to the northwest half as shown on Figure 4, page 485, and in detail on Map II, where it has been prospected considerably by natives for local domestic fuel. Its thickness and stratigraphic position are exhibited in the section given in Chapter IV for Big Otter—0.5 Mile Southeast, pages 107-9. On the waters of Walker Creek, the 5 following openings were examined by the writer:

W. S. Kelley Coal Opening—No. 216 on Map II.

On a branch of Walker Creek, ½ mile S. 70° W. of Lydia; **Pittsburgh Coal**; elevation, 1040′ B.; closed; **reported** by J. M. Downey to have a thickness of clean, hard coal of 4′ 0″ to 5′ 0″.

J. M. Downey Coal Opening—No. 217 on Map II.

On south hillside of Walker Creek, at Lydia; **Pittsburgh Coal**; elevation, 1055′ B.; closed; **reported** by Mr. Downey to be clean and hard, slightly over 3′ 0″ thick.

A. Jarvis Coal Opening—No. 218 on Map II.

0.3 mile S. 15° E. Lydia; **Pittsburgh Coal**; elevation, 1065′ B.; closed; **reported** by J. M. Downey to be slightly over 3′ 6″ thick.

Martin B. Siers Coal Opening—No. 219 on Map II.

On south hillside of Walker Creek, 1.5 miles S. 50° E. of Lydia; **Pittsburgh Coal**; elevation, 1155′ B.; closed; reported to be about 3′ 0″ thick.

James Richardson Coal Opening—No. 220 on Map II.

On north hill road, 1.0 mile S. 60° W. of Elmira; **Pittsburgh Coal**; elevation, 1170′ B.; opening locked and unable to measure; 3′ 0″ of coal visible from outside; clay vein cuts it out for some distance in; Mr. Richardson reports it 2′ 0″ to 5′ 0″ thick, and when the latter figure prevails, carries a thin (¼″ to ½″) black slate parting 12″ below top.

The above mine supplied coal for the region to the west and has a fine reputation for domestic purposes.

The two following diggings in Otter District (Clay County) on the waters of Stinson Creek were examined by the writer:

Amos Tanner Coal Opening—No. 221 on Map II.

On west hillside, ¾ mile N. 10° W. of Nebo; **Pittsburgh Coal**; elevation, 1055′ B.

	Ft.	In.
Sandstone, shaly, visible	7	0
Shale, gray, argillaceous	10	0
Coal, hard, blocky, (gray shale floor) 1′ 0″ to...	2	2

Charles Carpenter Coal Prospect—No. 222 on Map II.

On south hillside, 0.4 mile due east of Nebo; **Pittsburgh Coal**; elevation, 1155′ B.; **slaty coal**, 3″ to 4″, with sandstone roof.

J. M. Boggs Coal Opening—No. 223 on Map II.

On north side of knob, ¾ mile S. 10° W. of Big Otter; **Pittsburgh Coal**; elevation, 1322′ L.; closed; reported by J. M. Boggs 3′ 6″ thick, as shown in Big Otter—0.5 mile Southeast Section, Chapter IV, page 107.

In the same District, on the waters of Otter Creek, the two following openings were examined by Gawthrop:

Oliver Butler Heirs Coal Opening—No. 224 on Map II.

On south hillside, Butler Fork, 2.4 miles S. 70° E. of Big Otter; **Pittsburgh Coal**; elevation, 1420′ B.

			Ft.	In.
Concealed, from top of knob, estimated			75	0
Shale			2	0
Coal, Pittsburgh "Rider"			1	6
Shale, gray			5	0
Coal, good	0′	8″		
Slate, 0½″ to	0	1		
Coal, good	0	3		
Coal, slaty	0	10		
Coal, good (shale floor)	2	0	3	10

Samuel Duffield Coal Opening—No. 225 on Map II.

On head of Wilson Fork, 2.0 miles S. 50° W. of Servia; **Pittsburgh Coal**; elevation, 1310′ B.

			Ft.	In.
Coal, medium-soft (shale roof)	1′	2″		
Coal, slaty	0	6		
Coal	1	0		
Slate	0	3		
Coal (shale floor)	0	9	3	8

In the same District (Otter) of Clay County, the 3 following openings were examined by the writer:

Jake Mollohan et al. Coal Opening—No. 226 on Map II.

On east edge of hill road, on head of Boggs Fork, 1.3 miles S. 60° W. of Servia; **Pittsburgh Coal**; elevation, 1245′ B.

			Ft.	In.
Coal (soft shale, roof)	0′	4″		
Shale, gray, light	0	3		
Coal, semi-splint	1	9		
Coal, softer (slate floor)	1	6	3	10

Martin Hall Heirs Coal Opening—No. 227 on Map II.

On north side of branch of Boggs Fork, 1.8 miles N. 70° W. of Servia; **Pittsburgh Coal**; elevation, 1210′ B.

			Ft.	In.
Sandstone, Upper Pittsburgh, coarse, brown, massive, pebbly, makes cliff, visible			15	0
Coal	0′	3″		
Coal, slaty	0	2		
Coal, medium-hard (shale floor)	2	1	2	6

Coal Opening—No. 228 on Map II.

On east hillside of O'Brien Creek, 1.4 miles S. 40° W. of Servia; Pittsburgh Coal; elevation, 1290' B.

			Ft.	In.
Coal (shale roof)	1'	0"		
Shale, light-gray	0	3		
Coal	0	4		
Coal, slaty	0	2		
Coal (to slate floor)	3	0	4	9

In Otter District (Clay), the following opening was examined by Gawthrop:

J. M. McCracken Coal Opening—No. 229 on Map II.

On head of Road Fork of O'Brien Creek, ¼ mile southwest of road summit at low gap; Pittsburgh Coal; elevation, 1425' B.

			Ft.	In.
Shale, dark-gray, visible			5	0
Coal	2'	0"		
Shale, gray	0	5		
Slate, coaly	1	6		
Coal (shale floor)	2	6	6	5

The above opening is driven in about 50 feet. The coal is badly split up and section varies at all points.

Quantity of Pittsburgh Coal Available.

Based on the foregoing evidence and a planimetric determination of the minable area by R. C. Tucker from Map II as limited by Figure 4, the following estimate is made for the amount of Pittsburgh Coal in the area:

Probable Amount of Pittsburgh Coal.

Counties by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Braxton:					
Salt Lick......	3.5	16.12	10,316.8	1,572,899,328	62,915,973
Otter	3.5	46.00	29,440.0	4,488,422,400	179,536,896
Birch	3.0	20.60	13,184.0	1,722,905,120	68,916,205
Totals		82.72	52,940.8	7,784,226,848	311.369,074
Clay:					
Otter	3.0	9.98	6,387.2	834,679,296	33,387,172
Henry	2.5	0.66	422.4	45,999,360	1,839,974
Totals		10.64	6,809.6	880,678,656	35,227,146
Totals for Both Counties..		93.36	59,750.4	8,664,905,504	346,596,220

MINABLE COALS OF THE CONEMAUGH SERIES.

BAKERSTOWN COAL.

The Bakerstown Coal, described briefly in Chapter VI, page 212, appears to be the only bed of the Conemaugh Series to attain minable dimensions and purity in the territory of this Report. Its total area is outlined on Figure 5 along with that for the Campbell Creek (No. 2 Gas) and Sewell seams, the closer-hatched lines on which exhibiting the regions in which it is believed to be minable, while the broken hatching indicates its patchy character. Its detailed outcrop is shown on Map II. It has not been mined commercially in either county, but it has been prospected and opened at country banks quite extensively. Its thickness and character at these diggings will now be described by magisterial districts.

Salt Lick District, Braxton County.

In Salt Lick District, the thickness and stratigraphic position of the Bakerstown Coal are shown in the sections in Chapter IV for Orlando, Knawl—0.3 Mile Southeast, and Bulltown, pages 44, 49, and 53, respectively. On the waters of Knawl Creek, the 14 following diggings and openings were examined by Gawthrop:

Coal Stripping—No. 229A on Map II.

On hill road, head of Little Knawl Creek; **Bakerstown Coal**; elevation, 965′ B.; stripping, thickness concealed.

S. C. Fleming Coal Opening—No. 230 on Map II.

On west hillside of Little Knawl Creek, 1.7 miles S. 40° W. of Knawl; **Bakerstown Coal**; elevation, 865′ B.; closed, **reported** 2′ 0″ thick.

P. J. Fleming Coal Opening—No. 231 on Map II.

On north hillside of Little Knawl Creek, 2.0 miles N. 10°-15° E. of Bulltown; **Bakerstown Coal**; elevation, 810′ B.; opening closed; section below is as **reported** by Mr. Fleming.

	Ft.	In.
Slate	0	6
Coal (to shale floor)	2	2

C. C. Taylor Coal Opening—No. 232 on Map II.

Just east of road fork, 0.9 mile northwest of Knawl; **Bakerstown Coal**; elevation, 805′ L.; closed; **reported** 1′ 6″ thick (with 6″ slate top).

J. C. Garrett Coal Opening—No. 233 on Map II.

On south bank of Knawl Creek, 0.7 mile northwest of Knawl; **Bakerstown Coal**; elevation, 835′ B.; closed; **reported** 1′ 6″ thick (with 6″ slate top).

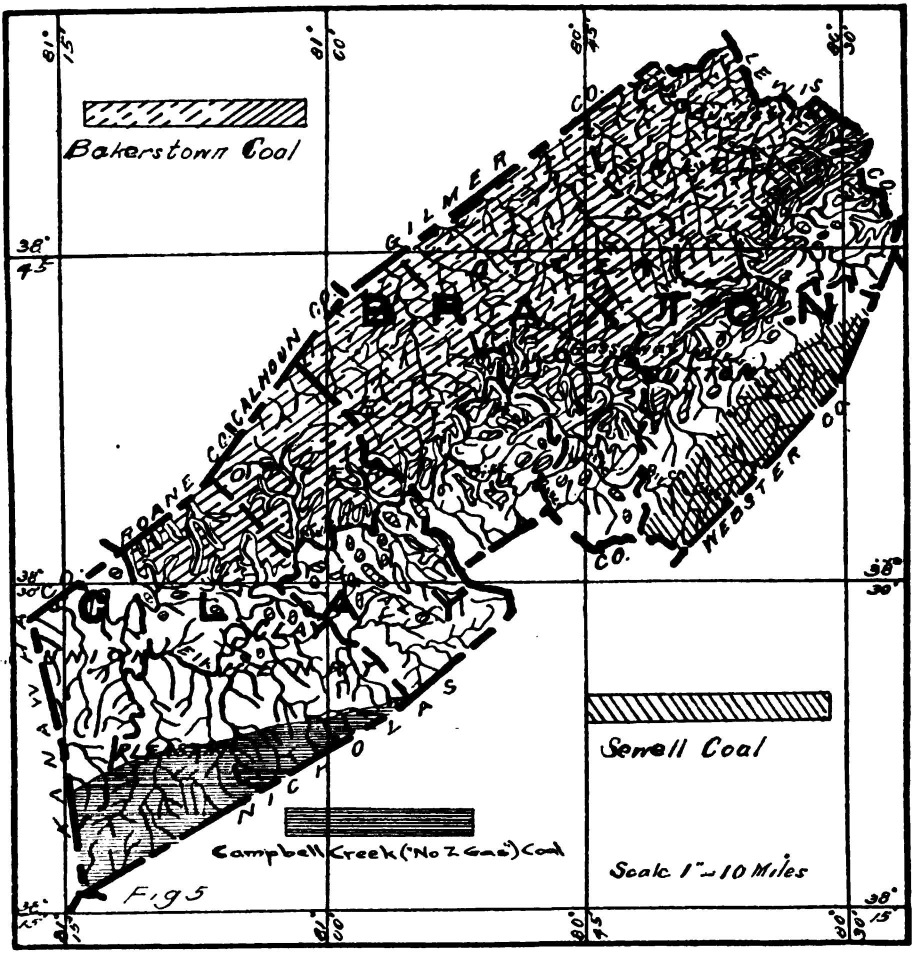

Figure 5.—Map Showing Approximate Minable Area of the Bakerstown, Campbell Creek (No. 2 Gas), and Sewell Coals (See Explanations in Author's Preface).

L. V. Pritt Coal Opening—No. 234 on Map II.

On east hillside of Barbecue Run, 0.3 mile northeast of Knawl; **Bakerstown Coal**; elevation, 970′ B.

		Ft.	In.
Shale, dark, slaty, visible		1	0
Bone	0′ 3″		
Coal, concealed, **reported**	2 0	2	3
Shale and concealed			

The Bakerstown Coal outcrops on the opposite side of Barbecue Run at an elevation of 950′ B.

Coal Opening—No. 235 on Map II.

On east bank of Barbecue Run, 1.0 mile northeast of Knawl; **Bakerstown Coal**; elevation, 955′ B.; closed, and could not get measurement.

J. H. Myers Coal Opening—No. 236 on Map II.

On east bank of Barbecue Run, 1.4 miles northeast of Knawl; **Bakerstown Coal**; elevation, 975′ B.; closed, (with slate roof) reported 2′ 0″ thick.

W. P. Myers Coal Opening—No. 237 on Map II.

On west hillside of Pigeonroost Fork, 0.4 mile southeast of Knawl; **Bakerstown Coal**; elevation, 1030′ B.

	Ft.	In.
Slate roof		
Coal, hard, opening closed, **reported**	2	0
Shale and concealed	40	0

Coal Opening—No. 238 on Map II.

On west hillside of Left Fork, 0.6 mile northeast of Knawl; **Bakerstown Coal**; elevation, 1015′ by hand-level; thickness not learned.

Coal Exposure—No. 239 on Map II.

In hill road, 2.0 miles N. 60° E. of Knawl; **Bakerstown Coal**; elevation, 1050′ B.; **coal blossom**, visible, 1′ 0″.

W. H. Cochran Coal Opening—No. 240 on Map II.

On south hillside of Left Fork, 1.75 miles due east of Knawl; **Bakerstown Coal**; elevation, 1095′ B.

			Ft.	In.
Shale, gray, siliceous, visible			5	0
Slate, black			1	0
Coal, hard	0′	10″		
Coal, bony	0	8		
Coal, hard (shale floor)	0	5	1	11

C. H. Harold Coal Opening—No. 241 on Map II.

On north hillside of Left Fork, 2.7 miles N. 85° E. of Knawl; **Bakerstown Coal**; elevation, 1115′ B.

			Ft.	In.
Shale, dark-gray, visible			5	0
Slate, black				
Coal, medium-hard	0′	10″		
Bone **coal**	0	1		
Coal, hard	0	2		
Bone **coal**	0	1		
Coal, hard, semi-splint	0	8	1	10
Shale, dark, slaty, and concealed				

Coal Opening—No. 242 on Map II.

On south edge of hill road, 1¼ miles due west of Ireland; **Bakerstown Coal**; elevation, 1175′ B.

			Ft.	In.
Slate, black, visible			0	6
Coal, weathered	1′	0″		
Coal, bony	0	5		
Coal, weathered (slate floor)	0	6	1	11

Coal Prospect—No. 243 on Map II.

On north edge of road, ½ mile east of Hettie and 2.0 miles west of Bablin; **Bakerstown Coal**; elevation, 1465′ B.; closed; shows black slate only, according to Gawthrop.

In the same District (Salt Lick), the two following exposures were observed by the writer:

Coal Exposure—No. 244 on Map II.

Exposed in edge of road, 0.8 mile S. 70° W. of Hettie; **Bakerstown Coal**; elevation, 1465′ B.; **coal blossom**, heavy, about 2′ 0″.

Coal Exposure—No. 245 on Map II.

Exposed in edge of road, 0.3 mile southwest of Opening No. 244 above; **Bakerstown Coal**; elevation, 1475′ B.; **coal blossom**, heavy, about 2′ 0″.

Jesse Mick Coal Prospect—No. 246 on Map II.

On west hillside of Keith Run, 1.3 miles N. 30° E. of Falls Mill; **Bakerstown Coal**; examined by Gawthrop; elevation, 1210′ B.

	Ft.	In.
Concealed, steep bluff	135	0
Coal, Bakerstown, prospect closed, reported 2′ 0″ to	2	10
Concealed	65	0
Coal, prospect closed, **Brush Creek**, reported	1	0

In the central portion of Salt Lick District, the two following exposures were examined by the writer:

G. W. Stalnaker Coal Opening—No. 247 on Map II.

On south bank of Little Kanawha River, 0.6 mile northwest of Bulltown; **Bakerstown Coal**; elevation, 795′ B., closed, reported 2′ 0″ to 3′ 0″ thick.

Coal Exposure—No. 248 on Map II.

In hill road, 0.3 mile westward from Bulltown; **Bakerstown Coal**; elevation, 880′ B.; exposed in edge of road, 1′ 6″ (See Bulltown Section in Chapter IV, page 53).

The 4 following openings were examined by Gawthrop in the same District:

B. E. Williams Coal Opening—No. 249 on Map II.

On east bank of Big Run, 1.0 mile S. 30° W. of Bulltown; **Bakerstown Coal**; elevation, 900′ B.

	Ft.	In.
Shale, gray	2	0
Fire clay, soft	0	2
Slate	0	2
Coal, hard	1	11
Shale and concealed to run	2	0

John Shields Coal Opening—No. 250 on Map II.

On east bank of Big Run, 0.2 mile southeast of Opening No. 249; **Bakerstown Coal**; elevation, 940′ B.

	Ft.	In.
Shale, dark	1	0
Fire clay	0	2
Slate	0	2
Coal, hard (to shale floor)	1	11

T. H. Lockard Coal Opening—No. 251 on Map II.

On east bank of Big Run, 1.3 miles S. 15° W. of Bulltown; **Bakerstown Coal**; butts, N. 80° W.; faces, N. 10° E.; elevation, 980′ B.

	Ft.	In.
Shale, gray, dark, visible	1	0
Slate, dark	0	3
Coal, hard (to shale floor)	1	8

Virginia Robinson Coal Opening—No. 252 on Map II.

On west hillside of Tyler Run, 1.4 miles southwest of Falls Mill; **Bakerstown Coal**; elevation, 1045′ B.

	Ft.	In.
Shale, reported	0	6
Coal, opening closed, reported	2	0

On Pickle Fork of Saltlick, in Salt Lick District, the 5 following openings on the Bakerstown were examined by the writer:

J. H. Finegan Coal Opening—No. 253 on Map II.

On head of Pickle Fork, ½ mile southeast of Opening No. 252; **Bakerstown Coal**; opening closed; elevation, 1170′ B.; **coal**, clean, bright, reported by Mr. Finegan the best in region and 1′ 10″ to 2′ 4″ thick.

J. H. Lake Coal Opening—No. 254 on Map II.

On head of Pickle Fork, 2.5 miles S. 3° E. of Bulltown; **Bakerstown Coal**; opening closed; elevation, 1230′ B.; **coal**, clean, known locally as "Pickle Fork" bed, reported by Mr. Lake 2′ 2″ thick.

Gertrude Sommerville Coal Opening—No. 255 on Map II.

On south hillside of Pickle Fork, 2.4 miles southeast of Saltlick Bridge; **Bakerstown Coal**; elevation, 1060′ B.; closed, could not get measurement.

Henry Hamilton Coal Opening—No. 256 on Map II.

On south hillside of Pickle Fork, 2.2 miles southeast of Saltlick Bridge; **Bakerstown Coal**; elevation, 1015′ B.; closed; thickness not learned.

J. M. Rose Coal Opening—No. 257 on Map II.

On south hillside of Pickle Fork, 1.5 miles southeast of Saltlick Bridge; **Bakerstown Coal**; butts, N. 75° W.; faces, N. 15° E.; elevation, 865′ B.

	Ft.	In.
Shale, visible	1	0
Fire clay	0	3
Slate, dark, soft	0	3
Coal, medium-hard (to shale floor)	2	4

At some places in this mine, there is a 6″ parting near the center of seam.

G. T. Herndon Coal Opening—No. 258 on Map II.

On north bank of Saltlick Creek, 0.1 mile above mouth of Pickle Fork and 0.6 mile southeast of Saltlick Bridge; **Bakerstown Coal**; examined by Gawthrop; elevation, 805′ B.

	Ft.	In.
Coal, opening closed, with slate parting, reported	3	0
Concealed to Saltlick Creek	15	0

The 9 following exposures and openings in Salt Lick District were examined by the writer:

Coal Exposure—No. 259 on Map II.

On east hillside of Saltlick Creek, 1.0 mile southeast of Saltlick Bridge; **Bakerstown Coal**; elevation, 835′ B.; **coal**, east edge of road, closed, thickness not learned.

Coal Exposure—No. 260 on Map II.

On east hillside of Saltlick Creek, 1.3 miles southeast of Saltlick Bridge; **Bakerstown Coal**; elevation, 850′ B.; **coal**, east edge of road, thickness not learned, opening closed.

Coal Opening—No. 261 on Map II.

On east hillside of Saltlick Creek, 1.5 miles southeast of Saltlick Bridge; **Bakerstown Coal**; elevation, 880′ B.

	Ft.	In.
Sandstone, visible	3	0
Coal, medium-hard (to gray shale floor)	2	9

A. H. Bright Coal Opening—No. 262 on Map II.

On east hillside of Saltlick Creek, 0.8 mile north of Corley; **Bakerstown Coal**; elevation, 915′ B.

	Ft.	In.
1. Sandstone, **Saltsburg**	30	0
2. Concealed and black sandy slate	5	0
3. **Coal**, medium-hard, bright (shale floor)	2	4

The analysis of a sample (885H) collected by the writer from No. 3 of above section, as reported by Messrs. Hite and Krak, is given under **No. 262** in the table of coal analyses at the end of this Chapter.

Coal Opening—No. 263 on Map II.

On north hillside of Spruce Fork, 1.0 mile N. 35° E. of Corley; **Bakerstown Coal**; elevation, 970′ B.; **coal**, 2′ 4″ to 2′ 6″ thick.

Coal Opening—No. 264 on Map II.

On south hillside of Spruce Fork, 1.0 mile N. 70° E. of Corley; **Bakerstown Coal**; elevation, 1095′ B.; closed, could not get measurement.

Jacob Weaver Coal Opening—No. 265 on Map II.

On point just northeast of Corley; **Bakerstown Coal**; elevation, 970′ B.

	Ft.	In.
Sandstone, shaly, visible	2	0
Shale, sandy, dark	0	6
Coal, medium-hard (gray shale floor)	0	6

M. E. Boyce Coal Opening—No. 266 on Map II.

On north hillside of Tom Hughes Fork, 1.3 miles southeast of Corley; **Bakerstown Coal**; elevation, 1190′ B.; **coal**, visible (thickness concealed by water) 2′ 4″ to 2′ 6″.

Coal Opening—No. 267 on Map II.

On south hillside of Tom Hughes Fork, 1.7 miles southeast of Corley; **Bakerstown Coal**; elevation, 1285′ B.; thickness not learned.

Holly District, Braxton County.

In Holly, the Bakerstown Coal is confined to the northwest portion of the District and it attains here the best development in either county. Its stratigraphic position is shown in the High Knob Section given in Chapter IV, page 93. It has been opened by natives for domestic fuel at several points, the following opening being examined by the writer:

J. W. Thompson Coal Opening—No. 268 on Map II.

On east hillside of branch of Tom Hughes Fork, 1.9 miles northwest of Caress; **Bakerstown Coal**; elevation, 1300′ B.; closed, reported 2′ 6″ thick.

Will Harris Coal Opening—No. 269 on Map II.

On east hillside of branch of Tom Hughes Fork, 0.55 mile north of High Knob; **Bakerstown Coal**; examined by Gawthrop; elevation, 1350′ B.; closed, thickness not learned.

The 8 following openings in Holly District were examined by the writer:

Washington Ware Coal Opening—No. 270 on Map II.

On north side of ridge road, 0.4 mile S. 85° E. of High Knob; **Bakerstown Coal**; elevation, 1430′ B.

			Ft.	In.
Coal, visible	1′	0″		
Slate, black, **coal** streaks	1	0		
Coal, bony	0	7		
Coal, good (to slate floor)	3	0	5	7

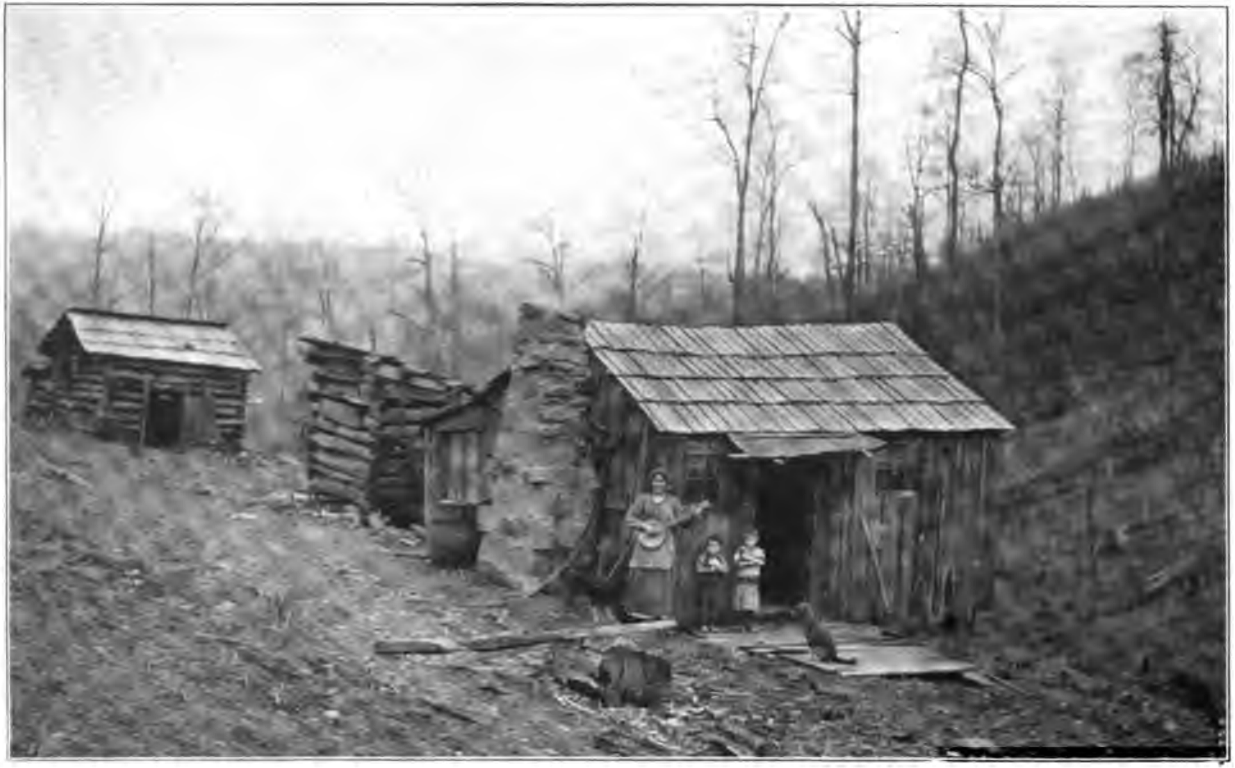

Photo by McClellan Leonard.

PLATE XX.—A mountain home in southeastern Clay County.

Alex. McQuain Coal Opening—No. 271 on Map II.

On west side of road, 0.33 mile S. 5° W. of High Knob; **Bakerstown Coal**; elevation, 1375' B.

			Ft.	In.
Sandstone, **Saltsburg**, medium-grained, visible			10	0
Shale, dark			5	0
Coal, medium-hard	0'	8"		
Slate, black, coal streaks	1	3		
Coal	0	2		
Shale, gray	0	4		
Coal, medium-hard, blocky	2	4	4	9
Slate floor, gray				

James Dennison Coal Opening—No. 272 on Map II.

On west side of ridge road, 1.3 miles N. 50° E. of Newville; **Bakerstown Coal**; elevation, 1465' B.; closed, reported 4' 0" thick.

Coal Opening—No. 273 on Map II.

On west side of ridge road, ⅛ mile southeast of Opening No. 272; **Bakerstown Coal**; elevation, 1480' B.

			Ft.	In.
Coal, bony (shale roof, bad)	1'	0"		
Shale, dark, thin coal streaks, 0" to	0	8		
Coal, good, medium-hard	2	10	4	6
Slate floor				

Coal Exposure—No. 274 on Map II.

On north bank of Saltlick Creek, 0.8 mile southeast of Flatwoods; **Bakerstown Coal**; elevation, 1025' B.; coal, slaty, at base of sandstone, 0' 6" thick.

B. & O. R. R. Coal Exposure—No. 275 on Map II.

In B. & O. R. R. cut, 1¾ miles southeast of Flatwoods; **Bakerstown Coal**; elevation, 1055' B.

	Ft.	In.
Sandstone, massive, **Saltsburg**	30	0
Shale, greenish-gray	1	0
Coal	0	2
Fire clay shale to railroad grade	10	0

Mary Morrison Coal Opening—No. 276 on Map II.

On east hillside, just northeast of B. & O. R. R., 2.0 miles southeast of Flatwoods; **Bakerstown Coal**; elevation 1125′ B.; closed, thickness not learned, but considerable coal has been mined here.

Charles Facemire Coal Opening—No. 277 on Map II.

In east edge of hill road, 1.4 miles N. 25° E. of Tesla, and 3.0 miles southeast of Sutton; **Bakerstown Coal**; elevation, 1385′ B.; closed; feathered out; slip encountered; reported 2′ 0″ to 2′ 6″ thick.

Otter and Birch Districts, Braxton County.

In Otter and Birch Districts, the Bakerstown Coal does not appear to attain minable dimensions and regularity, judged from its scanty occurrence at outcrop exposures, and its absence from the logs of many oil and gas well borings penetrating its horizon. Hence its area in the Districts in question is shown on Figure 5 by broken hatched-line shading, the same being true for the northwest portion of Salt Lick District. Its stratigraphic position is exhibited in Otter and Birch by the Gassaway—2 Miles West and Rosedale Sections, published in Chapter IV, pages 65 and 76, respectively.

The following exposure, examined by the writer, is characteristic of its occurrence at outcrop in this region:

Coal Exposure—No. 278 on Map II.

At road fork on Little Otter Creek, ¾ mile northwest of Gassaway; **Bakerstown Coal**; elevation, 820′ B.

	Ft.	In.
Coal, slaty, with yellow sandy shale cover......	0	1

Otter, Buffalo, Henry, and Union Districts, Clay County.

In Clay County, the Bakerstown Coal horizon is confined to the northern half in Otter, Buffalo, Henry, and Union Districts, but the bed appears to have the same scanty occurrence or patchy nature as in the two Districts last described in Braxton, and for that reason is not classed as minable, its areal extent being shown on Figure 5 by the broken hatched-line shading.

Quantity of Bakerstown Coal Available.

Based on the data given on preceding pages and a planimetric determination of the minable area by Tucker from Map II as limited on Figure 5, the following estimate is made for the probable amount of Bakerstown Coal available in the area.

Probable Amount of Bakerstown Coal.

Counties by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Braxton:					
Salt Lick.......	1.5	30.33	19,411.2	1,268,327,808	50,733,112
Holly	2.0	17.33	11,091.2	966,265,344	38,650,614
Totals		47.66	30,502.4	2,234,593,152	89,383,726

MINABLE COALS OF THE ALLEGHENY SERIES.

UPPER FREEPORT COAL.

The Upper Freeport Coal, described briefly in Chapter VII, pages 229-230, appears to attain minable dimensions, purity, and regularity in the southeast half of each County, as shown by the solid-line shading on Figure 6. Its horizon is below drainage over the northwest portions of Braxton and Clay, but in this region the logs of many oil and gas borings fail to record its presence. Its detailed outcrop is shown on Map II. It has never been mined commercially in the area, but it has been prospected considerably by natives for domestic fuel. Its thickness and character at these diggings and outcrop exposures will now be described by magisterial districts.

Salt Lick District, Braxton County.

In Salt Lick, the Upper Freeport Coal as a minable seam, is apparently confined to the southeast portion of the District, as exhibited on Figure 6, in which region it has been prospected quite extensively by natives in search for domestic fuel. Its stratigraphic position is shown in the Knawl—0.3 Mile Southeast Section, published in Chapter IV, page 49, and in the log of the J. T. Berry Coal Test Boring—No. 6 on Map II—½ mile southwest of Rollyson. The four following exposures and prospects on this bed on the waters of Knawl Creek were examined by Gawthrop:

Coal Exposure—No. 279 on Map II.

In bed of Knawl Creek, 0.4 mile southeast of Knawl; **Upper Freeport Coal**; elevation, 830′ B.

	Ft.	In.
Sandstone, flaggy, greenish-gray	5	0
Concealed in run bed, holding, **coal**, reported	1	0

Coal Exposure—No. 280 on Map II.

In hill road, head of Pigeonroost Fork, 1.75 miles S. 30° E. of Knawl; **Upper Freeport Coal**; elevation, 975′ B.

		Ft.	In.
Shale, dark-gray, visible		5	0
Coal	0′ 2″		
Fire clay	0 3		
Coal (to shale floor)	0 10	1	3

W. O. Mealy Coal Prospect—No. 281 on Map II.

On south hillside of Knawl Creek, 0.4 mile N. 70° E. of mouth of Pigeonroost Fork; **Upper Freeport Coal**; elevation, 905′ B.

	Ft.	In.
Sandstone, flaggy, shaly, visible	5	0
Shale, dark-gray, holding gray limestone nodules (weathers yellow)	7	0
Coal, concealed, with slate parting, reported about	2	0
Concealed to run	6	0

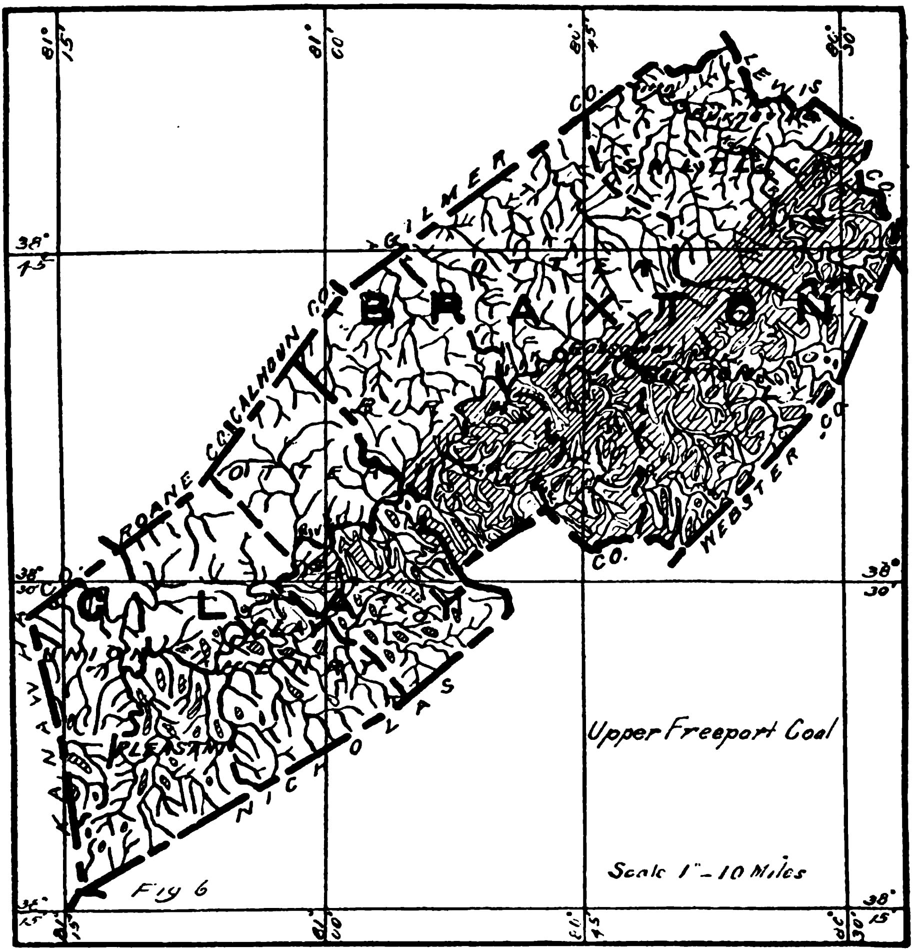

Figure 6—Map Showing Approximate Minable Area of Upper Freeport Coal (See Explanations in Author's Preface).

G. D. Walton Coal Exposure—No. 282 on Map II.

On south hillside of Knawl Creek, 0.6 mile due east of Opening No. 281; **Upper Freeport Coal**; elevation, 955′ B.; coal, edge of run, reported about 2′ 0″ thick.

On the waters of Falls Creek in the same District (Salt Lick), the writer examined the 4 following prospects and openings in this seam:

Coal Prospect—No. 283 on Map II.

On south side of road, 0.1 mile southwest of Letch P. O.; **Upper Freeport Coal**; elevation, 1030′ B.; exposure at schoolhouse, reported 1′ 0″ to 1′ 3″ thick.

Coal Opening—No. 284 on Map II.

On east hillside of Right Fork, 1.4 miles S. 55° W. of Letch; **Upper Freeport Coal**; elevation, 1055′ B.; thickness not learned.

Lee Bull Coal Opening—No. 285 on Map II.

On east hillside of Right Fork, 0.4 mile due south of Opening No. 284 above; **Upper Freeport Coal**; elevation, 1085′ B.; closed; reported 2′ 4″ to 2′ 6″ thick.

Lee Bull Coal Opening—No. 286 on Map II.

On east hillside of Right Fork, 0.4 mile S. 20° E. of Opening No. 284; **Upper Freeport Coal**; elevation, 1095′ B.; closed, reported 2′ 4″ to 2′ 6″ thick.

The four following openings on the waters of the Little Kanawha River in Salt Lick District were examined by the writer:

M. C. Bosely Coal Opening—No. 287 on Map II.

On east side of Little Kanawha River, ¼ mile southeast of Bulltown; **Upper Freeport Coal**; elevation, 780′ B.

	Ft.	In.
Sandstone, massive, coarse, grayish-white, pebbly, **Mahoning**, visible	15	0
Shale, dark-gray, argillaceous, **Uffington**, plant fossils	4	0

			Ft.	In.
Coal, slaty	0'	3"		
Shale, gray, coal streaks	1	6		
Coal, visible	0	6	2	3
Concealed to bed of run, holding coal			3	4

Mr. Bosely reports the coal as 3 to 4 feet thick, with 7-inch parting near middle.

Coal Opening—No. 288 on Map II.

On east side of Little Kanawha River; 0.4 mile southeast of Bulltown; **Upper Freeport Coal**; elevation, 805' B.

	Ft.	In.
Sandstone, **Mahoning**, coarse and pebbly		
Shale, gray, argillaceous, 5' 0" to	10	0
Coal, edge of road, opening closed, thickness not learned		

Coal Opening—No. 289 on Map II.

On east side of Little Kanawha River, 0.6 mile southeast of Bulltown; **Upper Freeport Coal**; elevation, 845' B.; closed; thickness not learned.

William Fisher Coal Opening—No. 290 on Map II.

On west hillside of England Run, 1.0 mile south of Gregory; **Upper Freeport Coal**; elevation, 1360' B.; closed, reported by Mr. Fisher, 1' 0" thick.

Holly District, Braxton County.

In Holly District, the Upper Freeport Coal appears to be present in minable dimensions and regularity over the greater portion as shown on Figure 6. Its thickness and stratigraphic position here are exhibited in the sections for Buckeye Creek and Erbacon, given in Chapter IV, pages 95 and 104, respectively, and the log of the Wm. Fisher well—No. 109A—slightly over a mile southwest of Flatwoods railroad station. This bed has been prospected considerably by natives for local domestic fuel, the following opening in the northeast corner of the District having been examined by the writer:

Jesse Arbogast Coal Opening—No. 291 on Map II.

On head of Long Fork of Laurelpatch, 1.0 mile southwest of Milroy; Upper Freeport Coal; elevation, 1490′ B.; opening closed; section as reported by Mr. Arbogast.

			Ft.	In.
Coal	0′	6″		
Shale, gray, soft	1	0		
Coal, medium-soft	1	0	2	6

The following opening in the same region was examined by Gawthrop:

J. W. McCray Coal Opening—No. 292 on Map II.

On south side of ridge road, 1.0 mile S. 20° W. of Milroy; Upper Freeport Coal; elevation, 1570′ B.; section as reported by Mr. McCray.

			Ft.	In.
Coal	0′	6″		
Slate	0	3		
Coal	0	6		
Slate	0	3		
Coal	1	10	3	4

The two following exposures in the same portion of Holly District were examined by the writer:

George Bankhead Coal Opening—No. 293 on Map II.

On south side of ridge road, 1.3 miles S. 35° E. of Milroy; Upper Freeport Coal; elevation, 1625′ B.

			Ft.	In.
Shale, gray, argillaceous			2	6
Shale, dark, coal streaks	0′	5″		
Shale, gray	0	2		
Coal, medium-hard (slate floor)	1	7	2	2

Coal Exposure—No. 294 on Map II.

In ridge road, 1.0 mile N. 45° W. of Replete; Upper Freeport Coal; elevation, 1680′ B.; coal blossom, in road, heavy, thickness not determined.

In the same general region of Holly District, the 3 following prospects and openings in the Upper Freeport Coal were examined by Gawthrop:

J. V. Cutlip Coal Prospect—No. 295 on Map II.

On east side of ridge road, 1.1 miles due north of Marpleton; Upper Freeport Coal; elevation, 1640′ B.

			Ft.	In.
Shale, dark-gray, roof				
Slate, coaly	0′	8″		
Coal	0	2		
Shale, gray	0	3		
Coal (to slate floor)	1	2	2	3

Frank Cutlip Coal Opening—No. 296 on Map II.

On east side of ridge road, 0.6 mile N. 20° W. of Marpleton, Upper Freeport Coal; elevation, 1620′ B.

			Ft.	In.
Slate, coaly (shale roof)	0′	10″		
Coal	0	2		
Shale	0	4		
Coal (to slate floor)	1	3	2	7

L. M. Roby Coal Opening—No. 297 on Map II.

On east side of ridge road, 0.6 mile N. 20° W. of Marpleton, Upper Freeport Coal; elevation, 1665′ B.

			Ft.	In.
Shale, dark, visible, Uffington			1	0
Coal	0′	3 ″		
Fire clay shale, dark, soft	0	4		
Coal, medium-hard	1	8		
Coal, bony	0	1½		
Coal, hard (to slate floor)	0	9½	3	2

In the same District, on the waters of Carpenter Fork of Saltlick Creek and on Tom Hughes Fork, the four following openings were examined by the writer:

William Nicely Coal Opening—No. 298 on Map II.

On east bank of Carpenter Fork of Saltlick Creek, 1.2 miles S. 10° E. of Corley; Upper Freeport Coal; elevation, 885′ B.

			Ft.	In.
Sandstone, visible, Lower Mahoning			5	0
Shale, buff and green	2′	0″ } Uffington	3	0
Shale, dark	1	0		
Coal, slaty	0′	7″		
Shale, dark	3	8		

			Ft.	In.
Coal and slate mixed	1′	2″		
Shale, gray	0	2		
Coal, medium-soft (slate floor)	2	3	7	10

Alvin Douglas Coal Opening—No. 299 on Map II.

On west bank of Carpenter Fork of Saltlick Creek, 1.8 miles S. 3° E. of Corley; **Upper Freeport Coal**; elevation, 955′ B.

			Ft.	In.
Concealed and slate				
Coal and slate mixed	1′	3″		
Coal, medium-hard (to slate floor)	1	8	2	11

P. R. Butcher Coal Exposure—No. 300 on Map II.

On east bank of Carpenter Fork of Saltlick Creek, 2.2 miles S. 3° E. of Corley; **Upper Freeport Coal**; elevation, 990′ B.

	Ft.	In.
Coal blossom, Upper Freeport		
Fire clay shale and concealed	5	0
Sandstone, shaly	7	0
Shale, sandy	3	0
Limestone, bluish-gray, hard, good, **Upper Freeport**	5	0
Shale and concealed to bed of Carpenter Fork	3	0

Jerry Harper Coal Opening—No. 301 on Map II.

East edge of hill road, 1.0 mile S. 60° W. of High Knob; **Upper Freeport Coal**; elevation, 1075′ B.

			Ft.	In.
Sandstone, visible			10	0
Shale, buff and green, **Uffington**			4	0
Coal, slaty	0′	8″		
Shale, gray and dark	4	0		
Coal and slate mixed	1	3		
Coal, medium-hard (slate floor)	1	3	7	2

Coal Exposure—No. 301A on Map II.

On head of Tom Hughes Fork, ¾ mile N. 45° W. of Caress; **Upper Freeport Coal**; elevation, 1285′ B.; **coal blossom**, heavy, at spring, thickness not learned.

The 7 following openings scattered in that portion of Holly District north of Elk River were examined by the writer:

Coal Opening—No. 302 on Map II.

On south hillside of Bens Run, at Newville; **Upper Freeport Coal**; elevation, 1250′ B.; closed and thickness not learned.

David Morton Coal Opening—No. 302A on Map II.

East edge of private road, 0.3 mile southeast of Newville; **Upper Freeport Coal**; elevation, 1290′ B.; **coal**, 1′ 0″ to 1′ 3″ thick.

G. W. Gillespie Coal Opening—No. 303 on Map II.

On east side of Flatwoods Run, 1.6 miles N. 20° W. of Gillespie; **Upper Freeport Coal**; elevation, 1065′ B.; closed, **reported** only 0′ 8″ to 0′ 10″ thick.

William Martin Coal Opening—No. 304 on Map II.

On east hillside of Bee Run, 1.2 miles due east of Sutton; **Upper Freeport Coal**; elevation, 950′ B.; closed, thickness concealed.

Coal Opening—No. 305 on Map II.

On north hillside of Elk River, 0.7 mile due east of Sutton; **Upper Freeport Coal**; elevation, 910′ B.

			Ft.	In.
Sandstone, **Lower Mahoning**, medium-grained, pebbly			17	6
Coal, slaty	0′	1½″		
Shale, gray, argillaceous	0	8		
Coal, medium-hard	1	9	2	6½

See Sutton Section, Chapter IV, pages 94-5, for stratigraphic position of Upper Freeport here.

Taylor Frame Coal Opening—No. 306 on Map II.

On north bank of Elk River, ¼ mile east of month of Old Woman Run above Sutton; **Upper Freeport Coal**; elevation, 830′ B.; closed, **reported** 2′ 6″ thick.

On the south side of Elk River in Holly District, the 3 following openings on Buckeye Creek were examined by Gawthrop:

Coal Opening—No. 307 on Map II.

On west bank of Buckeye Creek, 0.3 mile south from Elk River; **Upper Freeport Coal**; elevation, 865′ B.

	Ft.	In.
Concealed		
Coal, concealed, reported	2	6
Shale and concealed	5	0
Sandstone, massive, brown	8	0
Shale, brown, siliceous	5	0

Coal Opening—No. 308 on Map II.

On east hillside of Buckeye Creek, 1.1 miles south from Elk River; **Upper Freeport Coal**; elevation, 995′ B.; **coal**, (with shale roof and floor) 1′ 8″ thick. For stratigraphic position of the coal here, see Buckeye Creek Section, Chapter IV, pages 95-6.

Paul Teeter Coal Opening—No. 309 on Map II.

On west hillside of Buckeye Creek, 1.5 miles south from Elk River; **Upper Freeport Coal**; elevation, 1010′ B.

	Ft.	In.
Sandstone, flaggy	5	0
Shale, dark, siliceous, **Uffington**	5	0
Coal, about	2	0
Water and concealed	10	0
Sandstone to run	15	0

In the same region, the following exposure was examined by the writer:

Coal Exposure—No. 310 on Map II.

On east hillside of Buckeye Creek, 0.9 mile southeast of Opening No. 309 above; **Upper Freeport Coal**; elevation, 1105′ B.

			Ft.	In.
Sandstone, massive, coarse, brown, **Lower Mahoning**			15	0
Coal, slaty, 0″ to	0′	2″		
Shale, gray	0	10		
Coal	0	5	1	5
Fire clay shale			5	0
Concealed and shale to Buckeye Creek			10	0

The 5 following openings are scattered in the southeast portion of Holly District:

Coal Opening—No. 311 on Map II.

On west hillside of Wolf Creek, 0.6 mile north of mouth of Left Fork; **Upper Freeport Coal**; examined by Gawthrop; elevation, 1130 B'.

	Ft.	In.
Sandstone, shaly, brown, visible	5	0
Coal, opening closed, **reported**	2	0

John Carroll Coal Opening—No. 312 on Map II.

On east hillside of Twolick Run, 0.4 mile northwest of Tesla; **Upper Freeport Coal**; examined by the writer; elevation, 1235' B.; closed, on east side of road, **reported** about 2' 0" thick.

Coal Opening—No. 313 on Map II.

On east hillside of Twolick Run, 0.2 mile northwest of Tesla; **Upper Freeport Coal**; examined by Gawthrop; elevation, 1255' B.; closed, **reported** about 2' 0" thick.

Coal Opening—No. 314 on Map II.

On west hillside of branch of Little Birch River, 0.8 mile N. 15° W. of Ramp Run P. O.; **Upper Freeport Coal**; examined by the writer; elevation, 1570' B.; **coal**, opening closed, 25' above top of sandstone cliff, **reported** about 2' 0" thick.

E. J. Hall Coal Opening—No. 315 on Map II.

On east side of ridge road at Holstad, 3½ miles S. 45° W. of Centralia; **Upper Freeport Coal**; measured by the writer; elevation, 1715' B.

			Ft.	In.
Sandstone, grayish-brown, coarse, current-bedded, visible			6	0
Coal, bony	0'	3"		
Coal, medium-hard	2	0		
Slate, gray, dark	0	5		
Coal, medium-soft (slate floor)	0	8	3	4

Gawthrop also measured the above opening at another point in it, as follows:

				Ft.	In.
1.	Sandstone, massive, visible			8	0
2.	Shale, gray			0	3
3.	**Coal**, soft	2'	2"		
4.	Shale, gray	0	6		
5.	**Coal**, soft	0	7	3	3
6.	Shale and concealed				

The coal is not far from crop and is full of little mud seams and is all more or less muddy. The analysis of a sample (168G) collected from Nos. 3 and 5 of above section by Gawthrop, as reported by Messrs. Hite and Krak, is given under **No. 315** in the table of coal analyses at the end of this Chapter.

The following opening was examined by the writer in the edge of Webster County:

Coal Exposure—No. 316 on Map II.

In ridge road, 2 miles N. 20° W. of Erbacon; Upper Freeport Coal; elevation, 2035′ B.; coal, 3′ 0″ to 3′ 6″ thick.

The two following exposures were examined by the writer in Nicholas County:

James Rose Coal Opening—No. 317 on Map II.

On southeast edge of ridge road, 1.7 miles southwest of Waggy; Upper Freeport Coal; elevation, 2135′ B.; 45 feet above top of great Upper Freeport Sandstone cliff; coal reported 1′ 6″ thick.

Coal Exposure—No. 318 on Map II.

In hill road, 4.5 miles S. 25° W. of Little Birch P. O.; Upper Freeport Coal; elevation, 1745′ B.; coal blossom, trace, in road, 5 to 10′ above top of great conglomeratic Upper Freeport Sandstone.

Otter District, Braxton County.

In the southeast portion of Otter District, the Upper Freeport Coal has been opened by natives for local domestic fuel, but it is frequently split up with much slate to the extent that the bed as a whole is of doubtful value, although it is shown in this region as minable on Figure 6. The 5 following openings and exposures were examined by the writer:

Coal Opening—No. 319 on Map II.

On west side of Twolick Run, 0.2 mile west of Tesla; Upper Freeport Coal; elevation, 1275′ B.; closed, estimated about 2′ 0″ thick.

A. M. Frame Coal Opening—No. 320 on Map II.

On head of Buffalo Creek, 3¼ miles due south of Sutton; **Upper Freeport Coal**; elevation, 1150′ B.

			Ft.	In.
Concealed and fire clay shale, visible			0	2
Coal, slaty	0′	2″		
Shale, dark-gray	2	6		
Coal	0	8		
Shale, gray	0	4		
Coal and slate in layers	0	10		
Coal, good (slate floor) 7″ to	0	10	5	4

J. R. Dennison Coal Opening—No. 321 on Map II.

On branch of Buffalo Creek, 1.9 miles N. 40° W. of Tesla; **Upper Freeport Coal**; elevation, 1015′ B.; closed, but reported slaty and of practically the same thickness and character as at Opening No. 320 above.

Coal Exposure—No. 322 on Map II.

On east bank of Buffalo Creek, opposite mouth of Cunningham Fork; **Upper Freeport Coal**; elevation, 925′ B.; **coal**, exposed in road, about 2′ 0″ thick.

Here the Upper Freeport bed belongs 30 feet below the Mahoning Coal at **Exposure No. 40 on Map II**, the details of which are given in Chapter VI under the description of the latter seam, page 223.

Coal Exposure—No. 323 on Map II.

On east bank of Buffalo Creek, ½ mile northwest of Opening No. 322 above; **Upper Freeport Coal**; elevation, 890′ B.

			Ft.	In.
Sandstone, massive, visible			15	0
Shale, bluish-gray			0	6
Coal and slate	0′	6″		
Coal, slaty (shale floor)	1	0	1	6

In the central portion of Otter District, Braxton, the following exposure was examined by Gawthrop:

James Mace Coal Prospect—No. 324 on Map II.

On east bank of Buffalo Creek, 0.3 mile south from Elk River, and 2 miles southeast of Gassaway; Upper Freeport Coal; elevation, 885' B.; prospect closed; section as reported.

			Ft.	In.
Sandstone, massive, Lower Mahoning			10	0
Shale, bluish-gray, Uffington			6	0
Coal	0'	4"		
Shale	0	5		
Coal	0	6		
Slate	0	8		
Coal	0	10	2	9

In the same District, the 3 following exposures along the Coal and Coke Railway grade were examined by the writer:

Coal & Coke Railway Co. Coal Exposure—No. 325 on Map II.

In Coal & Coke Railway cut 1¼ miles N. 70° E. of Shadyside; Upper Freeport Coal; elevation, 845' B.

			Ft.	In.
Sandstone, Lower Mahoning, pebbly, massive, light-gray, visible			30	0
Coal	0'	0½"		
Shale, dark-gray	0	1½		
Coal	0	2		
Shale, gray	0	0½		
Coal	0	2		
Shale	0	0½		
Coal	1	1	1	8
Fire clay shale to railroad grade			5	0
Fire clay shale			5	0
Limestone, weathered yellow, siliceous, Upper Freeport			1	0

Coal & Coke Railway Co. Coal Exposure—No. 326 on Map II.

In Coal & Coke Railway cut, ¼ mile west of Exposure No. 325 above; Upper Freeport Coal; elevation, 840' B.

			Ft.	In.
Sandstone, coarse, pebbly, massive, Lower Mahoning			30	0
Coal	0'	2"		
Shale, gray	0	1		
Coal	1	2	1	5
Shale			3	0
Limestone, Upper Freeport			3	0

Coal & Coke Railway Co. Coal Exposure—No. 327 on Map II.

In Coal & Coke Railway cut, 0.8 mile southwest of Shadyside; Upper Freeport Coal; elevation, 845' B.

	Ft.	In.
Sandstone, massive, visible, Lower Mahoning...	20	0
Coal, Upper Freeport..........................	0	0½
Fire clay shale..............................	1	0
Limestone, Upper Freeport, lenticular, siliceous, ferriferous, 0" to..........................	1	3
Shale, gray..................................	3	0
Sandstone, shaly top, to railroad grade..........	10	0

Coal & Coke Railway Co. Coal Exposure—No. 328 on Map II.

In Coal & Coke Railway cut, 1¼ miles northwest of Shadyside; Upper Freeport Coal; elevation, 825' B.

	Ft.	In.
Sandstone, massive, Lower Mahoning...........		
Shale	1	0
Coal, Upper Freeport..........................	0	2
Fire clay shale..............................	2	0
Iron ore lenses, hollow concretions, Upper Freeport	0	6
Fire clay shale to railroad grade..............	3	0

In the southern point of Otter District (Braxton), the Upper Freeport Coal attains abnormal thickness locally, as shown in the following opening examined by the writer:

Lewis Long Coal Opening—No. 329 on Map II.

On north hillside of Little Birch River, 2.9 miles due east of Herold; Upper Freeport Coal; opening closed; elevation, 1350' B.

	Ft.	In.
Sandstone, visible............................	2	0
Concealed and slate..........................	3	0
Coal, medium-soft, bright......................	4	4
Shale, gray, pavement.........................	0	6

The above section was measured by the writer on the outside. The coal is reported to run from 4 to 6 feet without partings inside. It has long supplied the region with domestic fuel, being highly prized for this purpose, and belongs 150 feet above the Upper Kittanning seam. It appears to be only a pocket, however, since no such thickness is found at its many exposures in the immediate region.

Birch District, Braxton County.

In Birch District, the Upper Freeport Coal in minable thickness is apparently largely confined to the region southeast of Elk River, as shown on Figure 6. Its stratigraphic position is exhibited in the sections for Rosedale and Frametown-Eli Taylor Knob, published in Chapter IV, pages 76 and 81, respectively. The 3 following measurements were taken from exposures at crop:

Coal Exposure—No. 330 on Map II.

On west bank of Lower Rockcamp Run, 0.4 mile northwest from Elk River; **Upper Freeport Coal**; examined by Gawthrop; elevation, 830′ B.; **coal**, 9″ visible, but reported by native that bottom not reached at 2 feet.

Coal & Coke Railway Co. Coal Exposure—No. 331 on Map II.

In Coal & Coke Railway cut, 0.8 mile due east of Frametown; **Upper Freeport Coal**; elevation, 820′ B.

	Ft.	In.
Sandstone, massive, gray, medium-grained, basal 3′ conglomeratic, large quartz pebbles, **Lower Mahoning**	25	0
Coal, Upper Freeport, 0″ to	0	2
Fire clay shale	3	0
Shale with iron ore nodules, **Upper Freeport**	3	0

Twenty-five feet southwest of the above opening, the coal and shale are pinched out between two massive sandstones.

Coal Exposure—No. 332 on Map II.

On north bank of Elk River at Frametown; **Upper Freeport Coal**; examined by Gawthrop; elevation, 810′ L.

			Ft.	In.
Sandstone, massive, visible			5	0
Sandstone, shaly			6	0
Coal	0′	3″		
Shale	0	5		
Coal (shale floor)	0	11	1	7

The following opening in Birch District, examined by the writer, is the same as that referred to by I. C. White at the bottom of page 290 of Volume II of the State Survey Reports, and it fixes the underlying great conglomeratic sandstone of this region and along Elk River below Frametown as the Upper Freeport ledge:

Martin Rollyson (S. J. Duffield) Coal Opening—No. 333 on Map II.

On northwest side of long point, ½ mile due south of Glendon; **Upper Freeport Coal**; elevation, 880' B. (See Volume II, pages 290-1).

	Ft.	In.
Sandstone, green, flaggy, **Lower Mahoning**......	30	0
Concealed	15	0
Shale, buff, sandy..............................	10	0
Coal, opening closed, reported..................	4	0
Sandstone, **Upper Freeport**, great conglomerate, pebbly cliff, 40' 0" to......................	60	0

Jasper Parson Coal Opening—No. 334 on Map II.

On branch of Diatter Run, ¼ mile southeast of Twistville; **Upper Freeport Coal**; examined by Gawthrop; elevation, 975' B.

	Ft.	In.
Sandstone, massive to flaggy, medium-grained..	8	0
Shale, gray....................................	3	0
Coal, reported..............................	0	6
Concealed		

Henry District, Clay County.

In Clay County, the minable area of the Upper Freeport Coal appears to be confined to the southeast half as shown on Figure 6 where its outcrop, as exhibited on Map II, is confined high up near the ridge summits, but even in this region, it is quite patchy in its occurrence, its bed-section ranging from a few inches to over 5 feet at one opening. Its horizon is well defined, since it belongs at 5 to 20 feet above the great, pebbly Upper Freeport Sandstone ledge, the latter as already mentioned on preceding pages, being a prominent cliff-maker over a wide area. In Henry District, the coal has been opened at a few points by natives for local domestic fuel, the following having been examined by the writer in the northern edge:

Allie Davis Coal Opening—No. 335 on Map II.

On west bank of Camp Run, 0.1 mile above Simmons Fork; Upper Freeport Coal; elevation, 795′ B.

			Ft.	In.
Shale, sandy, visible			15	0
Coal and slate mixed	0′	4″		
Shale	0	2		
Coal	0	3		
Shale, gray	0	7		
Coal, medium-soft	2	2	3	6
Concealed by water				

Six to seven miles southeastward along the northeast border of the same District, Gawthrop examined the following opening where the bed attains abnormal development over a very restricted area:

H. Triplett Heirs Coal Opening—No. 336 on Map II.

On branch of Longs Run, 1.0 mile S. 5° E. of Swandale; Upper Freeport Coal; elevation, 1175′ B.

			Ft.	In.
Shale, brownish-gray, siliceous			5	0
Slate			0	6
Coal, soft	1′	8″		
Coal, bony	0	4		
Coal, soft	3	6	5	6
Shale and concealed			10	0
Sandstone, massive, coarse, pebbly, Upper Freeport			25	0

Slightly over a mile southwestward at **Coal Exposure No. 337** in the hill road, 1 mile northeast of Dundon, the Upper Freeport Coal is only 6 inches in thickness, at an elevation of 1180′ B., as shown in the Dundon Section, published in Chapter IV, page 132.

Pleasant District, Clay County.

In Pleasant District, the Upper Freeport Coal was observed definitely at only one point, the following prospect being examined by Gawthrop in the southeastern corner:

Coal Prospect—No. 338 on Map II.

On north side of road, low gap, 3½ miles northeast of Lizemores, and 0.9 mile northwest of Triplett School; Upper Freeport Coal; elevation, 1465′ B.

	Ft.	In.
Shale	2	0
Coal	1	0
Shale and concealed, holding massive sandstone, Upper Freeport	55	0

Union and Buffalo Districts, Clay County.

In Union District, the Upper Freeport Coal horizon is confined to a few scattered and isolated areas near the ridge summits. No prospects or diggings on it were observed nor was any coal seen at a few exposures of its horizon. However, its thickness and stratigraphic position are exhibited in the logs of the J. M. Young No. 1 well—No. 208 on Map II—1.5 miles southeast of Queen Shoals, and the Elk River Lumber Co. Coal Test Boring No. 2—No. 47 on Map II, 2 miles westward from Warfield, published on pages 430-1 and 482, respectively.

In Buffalo District, the horizon of the Upper Freeport Coal crops over a wide area in a much forested region. No coal was observed at either prospect openings or outcrop exposures. As in Henry, it is believed to be very irregular in its occurrence and of doubtful mining value.

Quantity of Upper Freeport Coal Available.

The following estimate is made for the probable amount of Upper Freeport Coal available in the area, based on the data given on preceding pages and a planimetric determination of the minable area by Tucker from Map II as limited on Figure 6:

Probable Amount of Upper Freeport Coal.

Counties by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Braxton:					
Salt Lick......	1.5	36.15	23,136	1,511,706,240	60,468,250
Otter	1.5	39.35	25,184	1,645,522,560	65,820,900
Birch	1.5	36.30	23,232	1.517,978,880	60,719,155
Holly	2.0	56.75	36,320	3,164,198,400	126,567,935
Totals		168.55	107,872	7,839,406,080	313,576,240
Clay:					
Otter	1.0	2.80	1,792	78,059,520	3,122,380
Buffalo	1.0	19.90	12,736	554,780,160	22,191,205
Henry	1.0	6.45	4,128	179,815,680	7,192,625
Pleasant	1.0	5.25	3,360	146,361,600	5,854,465
Union	1.0	4.65	2,976	129,634,560	5,185,385
Totals.............		39.05	24,992	1,088,651,520	43,546,060
Totals for Both Counties..		207.60	132,864	8,928,057,600	357,122,300

LOWER FREEPORT COAL.

The Lower Freeport Coal, described briefly in Chapter VII, page 234, as a minable bed, appears to be confined to a narrow belt—2 to 3 miles wide—along the southeast border of Salt Lick and Holly Districts, Braxton County, as shown on Figure 7. A careful analysis of all the data obtained at its crop exposures and in the logs of wells drilled for oil and gas leads to the conclusion that its occurrence is too scanty and irregular in other portions of the territory of this Report to warrant its classification as minable. No commercial mines occur on it in either county, but it has been prospected considerably by natives for local domestic fuel. Its thickness and character at these diggings and crop exposures will now be described by magisterial districts.

Salt Lick District, Braxton County.

In Salt Lick District, the thickness and stratigraphic position of the Lower Freeport Coal are exhibited in the Head of Knawl Creek Section in Chapter IV, page 49, and in the log of the J. T. Berry Coal Test Boring—No. 6 on Map II—½ mile southwest of Rollyson, pages 463-4. In the southeast

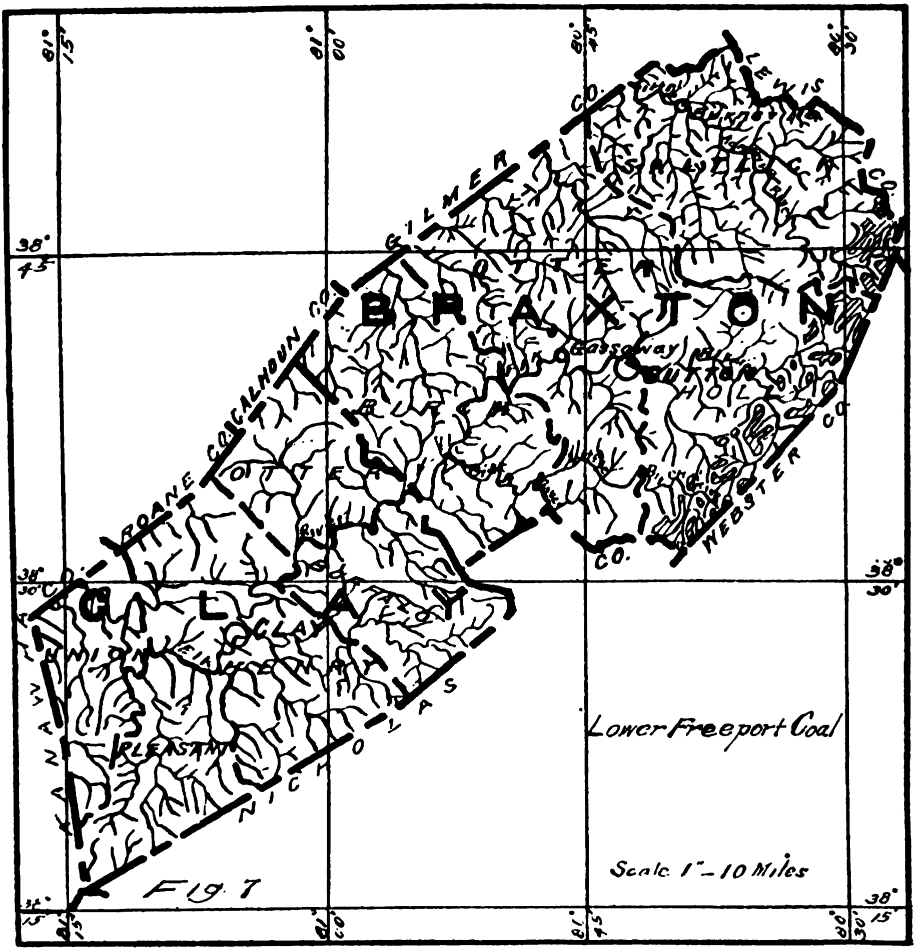

Figure 7.—Map Showing Approximate Minable Area of Lower Freeport Coal (See Explanations in Author's Preface).

edge of the District, mostly on the waters of Falls Creek, the 7 following openings and exposures were examined by the writer:

Ed. Cummins Coal Opening—No. 339 on Map II.

On south hillside of Falls Creek, 0.9 mile west of Joppa; **Lower Freeport Coal**; elevation, 1145′ B.; closed, reported 2′ 4″ to 2′ 6″ thick.

The coal at the following opening is locally known as the "Red Ash" seam:

J. F. Ancell Coal Opening—No. 340 on Map II.

On north hillside of Falls Creek, 0.2 mile northwest of Joppa; **Lower Freeport Coal**; elevation, 1145′ B.; section as reported by Mr. Ancell.

			Ft.	In.
Shale, gray, argillaceous, visible			3	0
Coal	1′	2″		
Slate, gray	0	2		
Coal	1	3	2	7

Coal Exposure—No. 341 on Map II.

On south hillside of Falls Creek, 0.8 mile east of Joppa; **Lower Freeport Coal**; elevation, 1175′ B.; **coal**, visible, 2′ 0″.

G. W. Bragg Coal Opening—No. 342 on Map II.

On south bank of Falls Creek, 1.4 miles N. 60° E. of Joppa; **Lower Freeport Coal**; elevation, 1130′ B.; coal reported by Mr. Bragg to be 3′ 0″ to 4′ 0″ thick.

Coal Opening—No. 343 on Map II.

On north edge of hill trail, 1.3 miles S. 87° E. of Joppa; **Lower Freeport Coal**; elevation, 1235′ B.

			Ft.	In.
Shale, sandy, gray			15	0
Coal, medium-hard	0′	3″		
Shale, gray, soft, dark at bottom	0	10		
Coal	0	2		
Slate, gray	0	1		
Coal, medium-soft (slate floor)	1	4	2	8

John D. Ware Coal Opening—No. 344 on Map II.

On east edge of hill road, 1.0 mile S. 40° E. of Joppa; **Lower Freeport Coal**; elevation, 1210′ B.; coal reported 2′ 6″ thick.

Jefferson Lowther Coal Opening—No. 345 on Map II.

On branch of Falls Creek, 1.0 mile S. 60° W. of Joppa; **Lower Freeport Coal**; elevation, 1165′ B.; closed; thickness not learned.

Holly District, Braxton County.

In Holly District, the Lower Freeport Coal in minable thickness and regularity appears to be confined to the southeast border, although thickened up locally northward from Palmer on Bens Run to dimension sufficient to warrant prospecting by natives for local domestic fuel. The 3 following openings on the latter stream were examined by the writer:

Richard I. Boyles Coal Opening—No. 346 on Map II.

On east bank of Bens Run, 1.0 mile northeast of Newville; **Lower Freeport Coal**; elevation, 1175′ B.; closed; reported by Mr. Boyles as clean, with thickness of 2′ 0″ to 2′ 2″.

The above opening belongs about 70 feet above the horizon of the Upper Kittanning seam.

J. R. Squires Coal Opening—No. 347 on Map II.

On Bens Run, 0.4 mile southeast of Opening No. 346; **Lower Freeport Coal**; elevation, 1200′ B.; closed; reported 1′ 6″ thick.

C. B. Beamer Coal Opening—No. 348 on Map II.

On east bank of Bens Run, 0.6 mile northeast of Newville; **Lower Freeport Coal**; elevation, 1190′ B.; closed; reported by Mr. Beamer as 1′ 0″ to 1′ 2″ thick.

The 7 following openings and exposures in Holly District were also examined by the writer:

D. A. Harper Coal Opening—No. 348A on Map II.

On south bank of Tom Hughes Fork, 0.8 mile N. 30° W. of Caress; Lower Freeport Coal; elevation, 1235′ B.; opening closed, reported 2′ 6″ thick.

The above opening belongs 55 feet above the Upper Kittanning bed and 50 to 60 feet below the Upper Freeport Coal at Opening No. 301A on Map II.

S. J. Skidmore Coal Opening—No. 349 on Map II.

East edge of road on Right Fork, 2¼ miles N. 25° W. of Palmer; Lower Freeport Coal; elevation, 1091′ L.; closed; reported 1′ 3″ thick.

Coal Exposure—No. 350 on Map II.

On west bank of Elk River, 0.5 mile N. 50° W. of mouth of Wolf Creek; Lower Freeport Coal; elevation, 860′ B.

	Ft.	In.
Sandstone, makes great cliff, Upper Freeport	50	0
Concealed in bench	5	0
Sandstone	15	0
Coal, Lower Freeport	0	10
Fire clay shale	1	0
Sandstone, shaly	5	0
Concealed to Elk River	45	0

Clifford Gillespie Coal Opening—No. 351 on Map II.

On west hillside of Robinson Run, 1.6 miles due south of Holly; Lower Freeport Coal; elevation, 1575′ B.

			Ft.	In.
Shale, dark, visible			3	0
Coal, medium-soft	0′	9″		
Coal and concealed by water to bottom of post	2	0	2	9

Mr. Dayton Wolverton, a native, reports the coal 3 feet thick, without partings, and medium-soft, at the above opening. It belongs about 60 feet above the horizon of the Upper Kittanning seam. It is barely possible that this coal may correlate with the Upper Freeport bed, since the opening is located in an isolated and forested region where the correlation of the adjacent members is more or less uncertain.

John Beamer Coal Opening—No. 352 on Map II.

On head of Lick Creek, 0.4 mile N. 3° W. of Holstead P. O.; Lower Freeport Coal; elevation, 1615′ B.

	Ft.	In.
Sandstone, coarse, base pebbly, visible, Upper Freeport	3	0
Shale, dark	3	0
Coal, medium-hard, concealed by water, reported by E. J. Hall as 2′ 4″ to	2	6

Marion Grose Coal Opening—No. 353 on Map II.

On head of branch of Brooks Creek, ⅛ mile S. 65° E. of Holstead; Lower Freeport Coal; elevation, 1745′ B.

		Ft.	In.
Sandstone, Upper Freeport, coarse, brown, pebbly, friable, visible		8	0
Coal, visible	1′ 7″		
Concealed by water	0 10	2	5
Concealed to great sandstone cliff		10	0

Coal Exposure—No. 354 on Map II.

In hill road, head of Spruce Fork of Wolf Creek, 2.5 miles due west of Centralia; Lower Freeport Coal; elevation, 1435′ B.; coal, 0′ 10″ visible.

Otter District, Braxton County.

In Otter District, the Lower Freeport Coal does not appear to attain minable dimensions and regularity, judged from its scanty occurrence in exposures at outcrop and the logs of oil and gas well borings, the single exception being the record of the Fred Depoy well—No. 76 on Map II—the details of which are published in Chapter IX, pages 320-321. The following prospect on the south side of Elk River in Otter District was examined by Gawthrop:

Coal Prospect—No. 355 on Map II.

On west bank of Buckeye Fork, 0.8 mile N. 70° W. of Canfield; Lower Freeport Coal; elevation, 1105′ B. Only a thin seam of coal found, with loose nodules of iron ore at opening.

The above prospect belongs about 70 feet above the horizon of the Upper Kittanning Coal.

The following opening was examined by the writer in the extreme southeastern point of Otter District:

Jonathan Pierson Coal Opening—No. 358A on Map II.

On east edge of hill road on head of Laurel Run, 2.9 miles S. 10° W. of Little Birch P. O.; Lower Freeport Coal; elevation, 1740′ B.; closed, reported 1′ 6″ to 2′ 0″ thick.

Birch District, Braxton County.

In Birch District, practically the same conditions prevail as regards the Lower Freeport Coal as in Otter. Its stratigraphic position is shown in the sections published in Chapter IV for Sleith—1¾ Miles Northeast, Glendon, and Head of Mill Run, pages 77, 86, and 89, respectively, and in the log of the Rebecca Bourn gas well—No. 100 on Map II, one mile southeast of Rosedale—the details of which are published in Chapter IX, page 331.

E. Armstrong Coal Opening—No. 356 on Map II.

On east bank of branch, north side of Elk River, 1.0 mile No. 20° E. of Glendon; Lower Freeport Coal; elevation, 790′ B.

	Ft.	In.
Sandstone, cliff, visible, Upper Freeport........	45	0
Coal, opening closed; once mined to furnish steam for a buhrstone flour mill on north side of Elk River; Mr. Armstrong reports it 2′ 6″ thick at entrance and that it thickens up to..................................	4	0

The above opening belongs 55 to 60 feet below the top of the conglomeratic Upper Freeport Sandstone and 150 to 160 feet below the top of the Upper Mahoning Sandstone.

Otter and Henry Districts, Clay County.

In Otter and Henry Districts, the Lower Freeport Coal occurs in practically the same condition as described for Otter in Braxton, although attempts by natives to mine it for domestic fuel have been made in Henry, where it is more or less bony and impure. Its thickness and stratigraphic position are exhibited in Valley Fork—1 Mile Southwest Section, published in Chapter IV, page 124. In the northwest corner of the same District, the two following openings were examined by the writer:

W. H. Ashley Coal Opening—No. 357 on Map II.

On west bank of branch of Horner Fork of Laurel Creek, 1.1 miles S. 20° W. of Barton; **Lower Freeport Coal**; elevation, 865' B.

			Ft.	In.
Sandstone, conglomerate, large quartz pebbles, visible, **Upper Freeport**			15	0
Coal, bony	0'	4"		
Coal, good, bright	1	2		
Coal, bony	0	9	2	3
Shale, sandy, to run			4	0

The above opening belongs about 75 feet above the horizon of the Upper Kittanning Coal.

William Procious Coal Opening—No. 358 on Map II.

On east bank of Horner Fork of Laurel Creek, 0.1 mile southeast of Opening No. 357 above; **Lower Freeport Coal**; elevation, 860' B.

	Ft.	In.
Sandstone roof, **Upper Freeport**		
Coal, slightly bony	2	6
Shale	2	0
Sandstone, coarse, to bed of run	4	0

Union and Pleasant Districts, Clay County.

In Union and Pleasant Districts, the Lower Freeport Coal possesses the same irregular character as in the areas last described, its thickness and stratigraphic position being exhibited in the Birch Section, given in Chapter IV, page 159, and in the log of the Elk River Lumber Co. No. 2 Coal Test Boring—No. 47 on Map II, 2 miles westward from Warfield. The following prospect in the western border of Union, examined by Gawthrop, was the only digging observed on this coal within the Districts in question:

A. L. Sample Coal Prospect—No. 359 on Map II.

On northeast slope of Carnes Knob, 0.9 mile S. 80° W. of Odessa; Lower Freeport Coal; elevation, 1120′ B.

	Ft.	In.
Shale, visible	5	0
Coal, reported (shale floor) 1′ 6″ to	1	8

Buffalo District, Clay County.

In Buffalo District, the Lower Freeport Coal has the same scanty occurrence as in those previously described for Clay County, and seldom exceeds one foot in thickness. The following digging on it was examined by the writer:

Elk River Coal & Lumber Co. Coal Opening—No. 360 on Map II.

On east edge of trail on ridge, 1.3 miles N. 45° E. of summit of Wallowhole Knob; Lower Freeport Coal; elevation, 1465′ B.; closed and abandoned; this digging was primarily for a spring, but coal fragments show on dump. Mrs. Robert Hamrick, residing here, did not know anything about thickness, but evidently it was only a few inches. Its stratigraphic position at this digging is shown in the Wallowhole Knob—2 Miles Northeast Section, published in Chapter IV, pages 133-4.

Quantity of Lower Freeport Coal Available.

Based on the foregoing evidence and a determination by Tucker from Map II of the minable area as limited on Figure 7, the following estimate is made for the probable amount of Lower Freeport Coal available in the area:

Probable Amount of Lower Freeport Coal.

Braxton County by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Salt Lick......	1.5	6.50	4,160	271,814,400	10,872,575
Holly	1.5	14.60	9,334	609,883,560	24,395,340
Total for County..		21.10	13,494	881,697,960	35,267,915

UPPER KITTANNING COAL.

The Upper Kittanning Coal, described briefly in Chapter VII, page 237, is one of the most valuable deposits of fuel in the territory of this Report. As shown on Figure 8, its approximate minable area is confined to the southeastern half of Braxton and the southern three-fourths of Clay County. Its detailed outcrop is given on Map II along with **structure contours in red** which exhibit its elevation above tide southeastward from its 500-foot level above the same datum. Northwest of this line the green contours are based on the Pittsburgh Coal, from which, in conjunction with the table of intervals published in Chapter III, pages 26-28, the position of the Upper Kittanning bed may be readily determined. It is this coal that was mined commercially in the extreme western point of Clay County at Queen Shoals and not the No. 5 Block bed as given in former State Survey Reports, including that for Kanawha County, as fully corroborated by the sections published in Chapter IV for Clay, Dorfee, Bomont—1 Mile Due East, and Queen Shoals, pages 129, 146, 161, and 154, respectively. The coal from the mine in question has an excellent reputation for both steam and domestic fuel, the latter being the only commercial operation on this bed in either county in 1915. It has been opened extensively by natives in both Braxton and Clay for domestic fuel. Its thickness and character at these country banks and other exposures will now be described by magisterial districts.

Salt Lick District, Braxton County.

In Salt Lick District, the apparent minable area of the Upper Kittanning Coal is confined to the southeast portion as shown on Figure 8, in which locality it has been prospected considerably by natives for local domestic fuel. Its thickness and stratigraphic position are exhibited in the sections published in Chapter IV for Falls Mill, Wildcat, and Cleveland, in the logs of Wells Nos. 2 and 48 on Map II; and the record of Coal Test Boring No. 6 on Map II. As shown on Map II, this coal lies below drainage over the greater portion of the northwest two-thirds of the District, but the evidence of many test wells for oil and gas influenced the writer in designating this region as barren of minable Upper Kittanning Coal. The three following openings on Falls Creek in the southeast portion of the District, were examined by the writer:

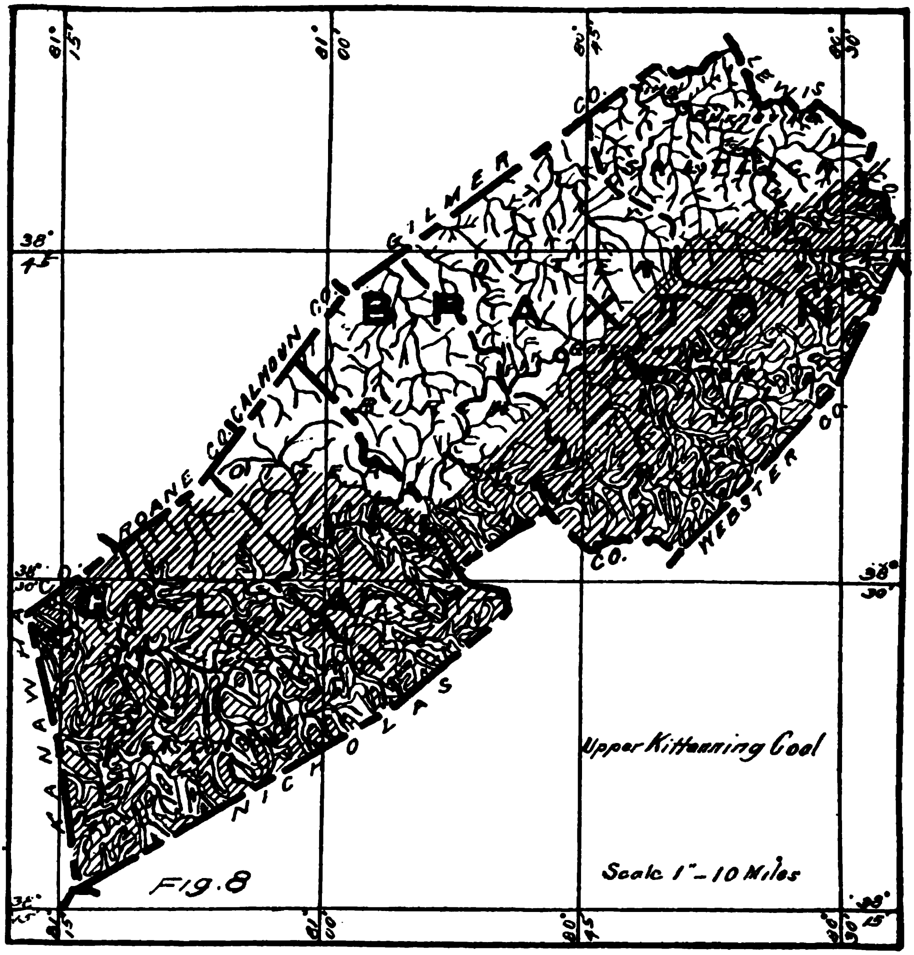

Figure 8.—Map Showing Approximate Minable Area of Upper Kittanning Coal (See Explanations in Author's Preface).

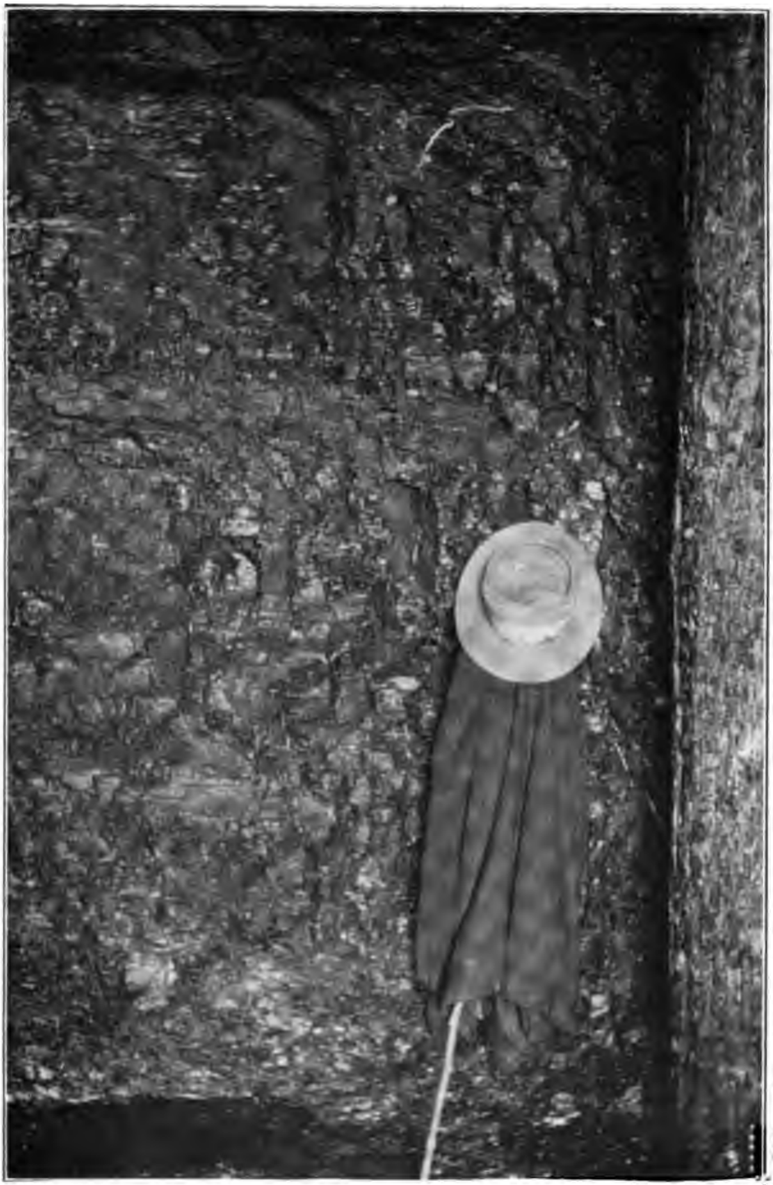

Photo by McClellan Leonard.

PLATE XXI.—Showing bed structure of Middle Kittanning Coal at Prospect Opening No. 538 on Map II. (See page 147).

MJ

Stewart Bird Coal Opening—No. 361 on Map II.

On south bank of Falls Creek, 0.9 mile due east of Joppa; Upper Kittanning Coal; elevation, 1090' L.

			Ft.	In.
Slate, black, cannelly, visible	1'	0"		
Coal, bony	2	4		
Slate, black, 2" to	0	3		
Coal (to slate floor)	0	6	4	1

J. F. Ancell Coal Opening—No. 362 on Map II.

On south side of Falls Creek, and road, 0.2 mile due west of Joppa; Upper Kittanning Coal; elevation, 1060' B.; closed; reported by Mr. Ancell 1' 3" thick.

M. L. Rexroad Coal Opening—No. 363 on Map II.

On west side of branch of Falls Creek, 0.6 mile southeast of Joppa; Upper Kittanning Coal; elevation, 1100' B.

			Ft.	In.
Coal, (slate roof), 4" to	0'	6"		
Slate, black, 8" to	1	0		
Coal, visible	1	0		
Concealed by water	1	0	3	6
Sandstone, massive, grayish-white			15	0

Slightly less than 2 miles eastward in the same District, the writer examined the following opening:

J. N. Lewis Coal Opening—No. 364 on Map II.

On head of Pretty Creek, 1.9 miles N. 5° E. of Wildcat; Upper Kittanning Coal; elevation, 1320' B.

			Ft.	In.
Shale, sandy, visible			2	0
Fire clay shale, dark			2	6
Coal, slaty	0'	7"		
Coal, medium-soft	1	4		
Bone, 4" to	0	0		
Coal, medium-soft (slate floor)	1	0	2	11

The four following openings along the Little Kanawha River in the same District (Salt Lick) were examined by the writer:

Herman Johnson Coal Opening—No. 365 on Map II.

On north bank of Little Kanawha River, 0.4 mile southeast of Falls Mill; Upper Kittanning Coal; elevation, 810' B.

			Ft.	In.
Sandstone, coarse, massive, visible			15	0
Coal, gas, medium-hard	1'	4"		
Slate, gray, hard, 0' 5" to	0	6		
Coal, medium-hard (to slate floor)	1	3	3	1

Tod Spour Coal Opening—No. 366 on Map II.

On south hillside of Little Kanawha River, 0.2 mile southeast of Falls Mill; Upper Kittanning Coal; elevation, 885' B.; closed; with slate parting, reported about 3 feet thick.

Floyd Spaur Coal Opening—No. 367 on Map II.

On north hillside of Little Kanawha River, 0.3 mile southeast of Falls Mill; Upper Kittanning Coal; elevation, 915' B.

			Ft.	In.
Fire clay shale, visible			3	0
Coal, 0" to	0'	7"		
Shale, gray, 2" to	0	6		
Coal, (shale floor) 3" to	1	0	2	1

The bed is very irregular, but it is undoubtedly the same seam as at Opening No. 365 above.

J. H. Finegan Coal Opening—No. 368 on Map II.

On west bank of run, 1.3 miles S. 5° W. of Falls Mill; Upper Kittanning Coal; elevation, 940' B.

			Ft.	In.
Sandstone, coarse, brown, tree fossils, visible			7	0
Fire clay shale, 0' 6" to			0	10
Coal, slaty, 2" to	0'	6"		
Fire clay shale, 0" to	2	0		
Sandstone, coarse, 10" to	1	0		
Coal, medium-hard	1	5		
Shale, dark-gray	0	3		
Coal, medium-hard	1	0	6	2
Shale, gray, and concealed to run bed			7	0

The five following openings in the southern edge of Salt Lick District were examined by the writer. In this region the cannelly and bony top bench of the Upper Kittanning Coal is frequently separated from the lower and purer bench by 5 to 10 feet of shales. It belongs here just 300 feet below the Bakerstown bed at Openings Nos. 266 and 267 on Map II in the latter coal.

Coal Opening—No. 369 on Map II.

On south bank of Tom Hughes Fork, 0.9 mile N. 30° W. of Caress; **Upper Kittanning Coal**; elevation, 1025′ B.; lower bench, opening closed; reported 2 to 3 feet thick.

Coal Opening—No. 370 on Map II.

On east bank of branch of Tom Hughes Fork, 2.1 miles N. 40° W. of Caress; **Upper Kittanning Coal**; elevation, 980′ B.

	Ft.	In.
Shale, buff and brown, sandy, visible..........	5	0
Coal, gas, medium-hard (to slate floor)..........	2	10

B. H. Adkinson Coal Opening—No. 371 on Map II.

On west bank of branch of Tom Hughes Fork, opposite Opening No. 370 above; **Upper Kittanning Coal**; elevation, 957′ L.

			Ft.	In.
Sandstone, visible..............................			15	0
Slate, black, cannelly, and **coaly**.........	2′ 10″	**Upper Kittanning "Rider"**	4	1
Coal, gas, medium-hard.	1 3			
Shale, dark....................................			1	5
Coal, slaty....................................			0	2
Shale, dark....................................			7	0
Coal, opening closed, thickness concealed, but same as lower bench mined at **Opening** No. 370			2	10
Concealed to bed of run.......................			4	0

The above opening belongs 300 feet below the Bakerstown bed also prospected in the same hill.

Coal Opening—No. 372 on Map II.

On west bank of Tom Hughes Fork, ¼ mile due west of Opening No. 371 above; **Upper Kittanning Coal**; elevation, 940′ B.

		Ft.	In.
Shale, sandy, dark, visible....................		3	0
Shale, gray....................................		0	10
Coal, bony.........................	0′ 2″		
Coal, gas (to slate floor)...........	4 3	4	5

Just west the following succession is exposed at an opening in the Upper Kittanning "Rider" Coal:

			Ft.	In.
Sandstone, coarse, visible			5	0
Slate, black, bony	1'	11"		
Coal, hard	1	6	3	5
Shale, gray			1	0
Concealed to Tom Hughes Fork			5	0

Joseph Gregory (Tom Nicely) Coal Opening—No. 373 on Map II.

On west hillside of Tom Hughes Fork, 1.7 miles due northwest of Caress; **Upper Kittanning Coal**; elevation, 1025' B.

			Ft.	In.
Cannelly bone (shale roof)	0'	5"		
Coal, medium-hard	5	6		
Shale, gray, 4" to	0	6		
Coal, softer, visible	3	0	9	5

The foregoing abnormal development of the Upper Kittanning Coal is caused by the local thickening of the hard "Rider" member, since absolutely the same beds are represented at Openings Nos. 371 and 373 on Map II.

Holly District, Braxton County.

As shown on Figure 8, the Upper Kittanning Coal appears to attain minable dimensions throughout the regions of its occurrence in Holly District. Its thickness and stratigraphic position are exhibited in the sections given in Chapter IV for Palmer and Erbacon, pages 97 and 104, respectively; in the log of the J. B. Marple well—No. 109C on Map II; and the record of the G. H. Ocheltree water well—No. 37 on Map II, just southeast of Sutton. In the northern edge of the District, the two following openings were examined by the writer:

David A. Harper Coal Opening—No. 374 on Map II.

On south bank of Tom Hughes Fork, 0.9 mile N. 30° W. of Caress; Upper Kittanning Coal; elevation, 1180' B.

					Ft.	In.
1.	Sandstone, coarse, brown, massive, visible..				6	0
2.	Coal, bony, 0" to.....	0'	2"			
3.	Coal, medium-soft....	1	9	Upper Kittanning "Rider"		
4.	Shale, gray, 3" to....	0	6			
5.	Coal, medium-soft, 10" to	1	0	....	3	5
6.	Slate, gray..................................				1	0
7.	Sandstone				0	3
8.	Coal, medium-soft, Upper Kittanning, 1' 2" to				1	8
9.	Slate floor..................................					

Nos. 5 to 8 of the above section are concealed, the data being supplied by Mr. Harper who dug through it in opening up bank.

Marshall Coger Coal Opening—No. 375 on Map II.

On south bank of Tom Hughes Fork, ⅛ mile northeast of Opening No. 374 above; Upper Kittanning Coal; elevation, 1180' B.

			Ft.	In.
Sandstone, massive, visible....................			2	0
Coal	1'	1"		
Shale, gray.........................	0	6		
Coal	1	0		
Concealed by water................	2	8	5	3

In the same general region of Holly District, the writer examined the four following openings on the waters of Kanawha Run:

Isaac Ware Coal Opening—No. 376 on Map II.

On east bank of Kanawha Run, 1.8 miles N. 30° W. of Holly; Upper Kittanning Coal; elevation, 1200' B.

				Ft.	In.
Shale, sandy, visible.........................				4	0
Coal, bony...........	0'	9"	Upper Kittanning "Rider"	2	10
Shale, gray, sandy....	0	4			
Coal, semi-splint......	1	0			
Coal, bony, cannel....	0	9			
Shale and concealed...........................				10	0
Coal, semi-splint......	3'	2"	Upper Kittanning	4	11
Bone	0	1			
Coal, semi-splint......	1	8			
Slate, gray, visible...........................				1	0

Isaac Ware Coal Opening—No. 377 on Map II.

On east hillside of Kanawha Run, 1.5 miles N. 30° W. of Holly; **Upper Kittanning Coal**; elevation, 1220′ B.

	Ft.	In.
Coal, opening closed, much bony refuse		
Concealed, 5′ 0″ to	10	0
Coal, semi-splint	4	2
Shale, visible	3	0

Theodore Beamer Coal Opening—No. 378 on Map II.

On east hillside of Kanawha Run, 0.1 mile southeast of Opening No. 377; **Upper Kittanning Coal**; elevation, 1230′ B.

	Ft.	In.
Coal, semi-splint (with shale roof and gray slate floor)	4	5

Isaac Grim Coal Opening—No. 379 on Map II.

On east side of hill road, 0.6 mile S. 15° E. of Caress; **Upper Kittanning Coal**; elevation, 1285′ B.; opening closed; section as given by Mr. Grim.

			Ft.	In.
Coal, medium-soft (slate roof)	2′	4″		
Slate, gray	0	8		
Coal, medium-soft (slate floor)	1	0	4	0

In the same region, the following opening was measured by Gawthrop:

J. D. Skidmore Coal Opening—No. 380 on Map II.

On south edge of road, 1.3 miles N. 30° E. of Holly; **Upper Kittanning Coal**; elevation, 1420′ B.; opening closed; section as reported by Mr. Skidmore.

			Ft.	In.
Coal	0′	2″		
Shale	1	0		
Coal	1	10	3	0

Two and a half miles westward in the same District (Holly), the writer examined the two following openings in this bed on Bens Run:

W. D. Holland Coal Opening—No. 381 on Map II.

On south bank of Bens Run at east edge of Newville; Upper Kittanning Coal; elevation, 1135′ B.; coal, soft, opening closed; reported by Mr. Holland 4′ 0″ thick.

Mike Williams Coal Opening—No. 382 on Map II.

On west hillside of Bens Run, 0.6 mile southwest of Newville; Upper Kittanning Coal; elevation, 1160′ B.

			Ft.	In.
Coal, bony (shale roof)	0′ 8″	Upper Kittanning "Rider"	2	0
Coal, medium-soft	1 4			
Shale and concealed			8	0
Coal, Upper Kittanning, opening closed, reported about			3	0

Westward in Holly District along the north side of Elk River, the writer examined the 6 following openings in the Upper Kittanning Coal:

Coal Opening—No. 383 on Map II.

On point, ¾ mile north of mouth of Holly River; Upper Kittanning Coal; elevation, 1265′ B.; for stratigraphic position, see Palmer Section in Chapter IV, page 97.

		Ft.	In.
Sandstone, grayish-white, coarse, making great cliff, Lower Freeport		75	0
Shale, gray		1	0
Coal, bony	1′ 0″		
Coal, medium-soft	2 3	3	3
Slate and concealed and shale		15	0
Sandstone, making great cliff, Upper East Lynn		55	0

Homer Hyer Coal Opening—No. 384 on Map II.

On north bank of branch of Flatwoods Run, 1.1 miles N. 20° W. of Gillespie; Upper Kittanning Coal; elevation, 1010′ B.; lower bench, reported 1′ 2″ thick.

Coal Prospect—No. 385 on Map II.

On west hillside of Elk River, ¾ mile due north of mouth of Stony Creek; Upper Kittanning Coal; elevation, 940′ B.

		Ft.	In.
Sandstone, coarse, brown, visible		5	0
Coal	1′ 6″		
Shale, gray	0 5		
Coal, slaty (slate floor)	0 4	2	3

Granville & Jacob Huffman Coal Opening—No. 386 on Map II.

On north hillside of Elk River, 1.1 miles northeast of mouth of Wolf Creek; **Upper Kittanning Coal**; elevation, 870′ B.

			Ft.	In.
Sandstone, visible			3	0
Coal, cannelly bone	0′	6″		
Fire clay shale, dark, sandy	0	6		
Shale, sandy, dark	8	0		
Coal, splinty (slate floor)	2	0	11	0

About 200 yards east of Opening No. 386 above, the following section of the **Upper Kittanning Coal** was measured by the writer on the same lands:

			Ft.	In.
Concealed				
Shale, sandy			8	0
Coal, slaty	0′	6″		
Coal, splinty (870′ B.)	3	0	3	6
Slate			5	0
Sandstone				

S. B. Miller Local Mine Opening—No. 387 on Map II.

On north hillside of Elk River, 0.1 mile north of mouth of Wolf Creek; **Upper Kittanning Coal**; elevation, 845′ B.

			Ft.	In.
Shale, sandy, visible			5	0
Coal, bony	0′	2″		
Coal, semi-splint, 2′ 0″ to	3	0	3	2
Slate floor				

When visited in August, 1915, the above bank was being worked to supply a part of the domestic fuel for Sutton.

Coal Opening—No. 388 on Map II.

At mouth of Bee Run, 1.0 mile due east of Sutton; **Upper Kittanning Coal**; elevation, 815′ B.; closed; reported 2′ 0″ to 3′ 0″ thick.

Eastward from Palmer in Holly District in the region north of Elk River, the writer obtained the following data at two openings and one exposure:

Alpheus Morrison Coal Opening—No. 389 on Map II.

On south hillside of Holly River, 1.5 miles due east of Palmer; **Upper Kittanning Coal**; elevation, 1330′ B.; **coal**, semi-splint (with slate roof and floor) 4′ 3″ thick.

The blossom of the Upper Kittanning Coal is exposed on the north hillside of Elk River, 2.3 miles northeast of Centralia, at an elevation of 1750′ B., at **Exposure No. 389A on Map II.**

David Morton Coal Opening—No. 390 on Map II.

On bank of run, 0.4 mile southeast of Newville; **Upper Kittanning Coal**; elevation, 1160′ B.

			Ft.	In.
Coal, medium-hard (shale roof)	0′	9″		
Slate, 2″ to	0	3		
Coal, medium-soft	1	6	2	6
Slate, gray, to bed of run			1	0

On the south side of Elk River in Holly District, the three following openings were examined by the writer:

Lon Kelly Coal Opening—No. 391 on Map II.

On south bank of Elk River, 0.33 mile southwest of mouth of Wolf Creek; **Upper Kittanning Coal**; elevation, 850′ B.

			Ft.	In.
Sandstone, massive, visible			30	0
Coal, bony, cannel	0′	6″		
Fire clay shale, dark	1	6		
Coal, bony	0	4		
Fire clay shale, dark	4	0		
Coal, semi-splint	2	8		
Slate, dark, sandy	0	3		
Coal, softer	0	5	9	8
Shale, gray, floor			0	5
Concealed to Elk River			35	0

The above mine furnishes a portion of the domestic supply of coal for Sutton. This bed was erroneously correlated in former State Survey Reports with the Lower Kittanning, but a careful study of the Sutton and Palmer Sections, published in Chapter IV, pages 94 and 97, respectively, shows that it belongs 90 to 110 feet higher in the measures. This bed, along with its immediately associated sandstone cliffs can be readily traced along the valley walls of Elk River from Sutton to Palmer.

Charles Duffield Coal Opening—No. 392 on Map II.

On south bank of Elk River, 0.1 mile southeast of Opening No. 391 above; Upper Kittanning Coal; elevation, 860' B.

			Ft.	In.
1. Shale roof				
2. Coal, medium-soft	0'	5"		
3. Coal, semi-splint, hard	2	0	2	5
4. Slate floor				

The above mine furnishes domestic fuel for the town of Sutton. The analysis of a sample (896H) collected by the writer from Nos. 2 and 3 of above section, as reported by Messrs. Hite and Krak, is given in the table of coal analyses at the end of this Chapter under **No. 392.**

R. D. Green Coal Opening—No. 393 on Map II.

In bed of Givens Fork of Stony Creek at Thrash, 3.4 miles southwest of Palmer; Upper Kittanning Coal; elevation, 1250' B.

			Ft.	In.
Coal, visible	0'	11"		
Shale, gray	0	6		
Coal	0	9	2	2
Slate and concealed by water				

In the same District (Holly), the 7 following openings on the waters of Wolf Creek were all examined by Gawthrop except No. 399, the data on the latter being obtained by the writer:

Coal Prospect—No. 394 on Map II.

On west hillside of Wolf Creek, ½ mile north of mouth of Left Fork; Upper Kittanning Coal; elevation, 970' B.

				Ft.	In.
Sandstone. shaly				5	0
Coal, semi-splint	1'	3"	Upper		
Coal, splint	1	3	Kittanning		
Coal, softer	0	4		2	10
Shale and concealed				10	0

	Ft.	In.
Sandstone	5	0
Concealed	15	0
Sandstone, massive	15	0
Coal	0	2
Sandstone, flaggy	15	0
Concealed to run, holding Middle Kittanning? Coal at bottom	5	0

Coal Opening—No. 395 on Map II.

On east hillside of Wolf Creek, 0.9 mile south of mouth of Left Fork; **Upper Kittanning Coal**; elevation, 1130′ B.

			Ft.	In.
Sandstone, massive, visible			5	0
Coal, medium-hard	1′	0″		
Coal, slaty	1	0		
Coal, hard, splinty	2	0	4	0
Shale and concealed			20	0
Sandstone, massive, pebbly			20	0
Concealed			10	0
Sandstone, shaly			30	0
Concealed to run			15	0

Ben Marlow Coal Opening—No. 396 on Map II.

On east hillside of Wolf Creek, 1.3 miles south of mouth of Left Fork; **Upper Kittanning Coal**; also examined by the writer; elevation, 1210′ B.

			Ft.	In.
Sandstone, massive, visible			8	0
Coal, semi-splint	2′	0″		
Coal, gray splint	1	8	3	8
Shale and concealed			5	0
Sandstone, massive			15	0

Barley Fisher Coal Opening—No. 397 on Map II.

On west hillside of Wolf Creek, 1.5 miles south of mouth of Left Fork; **Upper Kittanning Coal**; also examined by the writer; elevation, 1195′ B.

			Ft.	In.
Sandstone, visible			5	0
Coal, hard	0′	8 ″		
Coal, slaty	0	3½		
Coal, cannel	0	3½		
Slate	0	3		
Coal, semi-splint	1	4		
Coal, splint	1	8	4	6
Shale and concealed				

The above opening comes 80 feet above the well mouth of the Barley Fisher Coal Test Boring—No. 38 on Map II—the detailed log of which is given on page 470 in this Chapter.

F. D. Stalnaker Coal Opening—No. 398 on Map II.

On west hillside of Left Fork of Wolf Creek, ¾ mile northwest of mouth of Spruce Fork; Upper Kittanning Coal; elevation, 1215' B.

			Ft.	In.
Sandstone, massive to flaggy, gray, making cliff, micaceous, medium-grained			45	0
Concealed			64	0
Sandstone			5	0
Shale			1	0
Coal, weathered	0'	8"		
Coal, medium-hard	1	6		
Coal, slaty	0	2		
Coal, semi-splint	1	6		
Coal, splint	1	6	5	4
Shale and concealed to bench				

McCarty Coal Opening—No. 399 on Map II.

On east hillside of branch of Spruce Fork, 3.5 miles due west of Centralia; Upper Kittanning Coal; elevation, 1285' B.; closed; reported 3' 0" to 4' 0" thick.

R. M. Gross Coal Opening—No. 400 on Map II.

On head of branch of Left Fork of Wolf Creek, 0.7 mile S. 5° W. of mouth of Spruce Fork; Upper Kittanning Coal; elevation, 1310' B.

				Ft.	In.
Shale, siliceous, visible				5	0
Coal	0'	6"			
Shale, black	0	4	Upper		
Coal, slaty	0	8	Kittanning		
Shale	1	6			
Coal, visible	2	0		5	0
Concealed				10	0
Sandstone, massive to flaggy, medium-grained, micaceous				45	0
Concealed to Lower Kittanning Coal at Opening No. 583				65	0

The two following openings in the southeast border of Holly District on the waters of Laurel Creek were examined by the writer:

Coal Opening—No. 401 on Map II.

On north bank of Lick Creek, 0.7 mile northeast of Holstead; Upper Kittanning Coal; elevation, 1505' B.

			Ft.	In.
Sandstone, visible			1	0
Coal, bony	2'	2"		
Shale, sandy and dark	9	0		
Coal, slaty	1	1		
Shale, light-gray	0	7		
Coal	0	4	13	2

E. J. Hall Coal Opening—No. 402 on Map II.

0.2 mile southeast of Holstead and 2.2 miles southwest of Prestonia; Upper Kittanning Coal; elevation, 1615' B.

			Ft.	In.
Sandstone, coarse, brown, visible			10	8
Fire clay shale			0	8
Coal, slaty	0'	6"		
Shale, dark-gray	0	5		
Coal, medium-hard	0	8		
Slate, dark, hard	0	8		
Coal, medium-soft (slate floor)	1	6	3	9

In the southwestern edge of Holly District, the three following diggings were examined by the writer:

Coal Stripping—No. 403 on Map II.

In bed of Twolick, 0.2 mile south of Tesla; Upper Kittanning Coal; elevation, 1175' L.

			Ft.	In.
Shale, sandy, dark, visible			5	0
Coal, bony, cannel	0'	4"		
Shale and concealed	3	6		
Coal, hard, reported	1	6	5	4

Henry A. Long Coal Prospect—No. 404 on Map II.

On east hillside of Twolick, 0.3 mile south of Tesla; Upper Kittanning Coal; elevation, 1210' B.

	Ft.	In.
Sandstone, pebbly, coarse, visible, Lower Freeport	20	0
Coal, slaty	0	1
Fire clay shale	1	3
Concealed, not much coal found, opening closed.		

Henry Long Coal Opening—No. 405 on Map II.

On east hillside of Twolick, 0.5 mile south of Tesla; Upper Kittanning Coal; butts, S. 85° E.; faces, N. 5° E.; elevation, 1215' B.

			Ft.	In.
Sandstone, pebbly			20	0
Coal, bony, 0" to	0'	3"		
Shale, gray, sandy, 4' 0" to	5	0		
Coal, medium-soft	1	6	6	9
Fire clay, visible			0	6

Another opening near by is reported with a thickness of 3 feet.

The 6 following openings in the southern portion of Holly District, on the waters of Little Birch River, were examined by Gawthrop:

Perry Roberts Coal Opening—No. 406 on Map II.

On branch of Seng Run, 0.9 mile S. 45° E. of Tesla; Upper Kittanning Coal; elevation, 1295' B.

			Ft.	In.
Sandstone, shaly, visible			15	0
Coal, gas, medium-soft	1'	8"		
Slate, 0' 2" to	0	1		
Coal, little harder	1	3	3	0
Shale and concealed to top of Upper East Lynn Sandstone			30	0

Coal Prospect—No. 407 on Map II.

On point northeast of mouth of Fisher Run, 1.0 mile west of Ramp Run P. O.; Upper Kittanning Coal; elevation, 1425' B.; coal, soft, prospect closed, reported 2' 6" thick.

J. I. Burton Coal Opening—No. 408 on Map II.

On west hillside of branch, 0.4 mile north of Ramp Run P. O.; Upper Kittanning Coal; also examined by the writer; elevation, 1475' B.

				Ft.	In.
1.	Sandstone, visible			3	0
2.	Shale, slaty			1	0
3.	Coal, semi-splint	1'	0"		
4.	Coal, splint	1	6		
5.	Coal, softer (shale floor)	0	6	3	0

The analysis of a sample (166G) collected by Gawthrop from Nos. 3, 4, and 5 of above section, as reported by Messrs. Hite and Krak, is given in the table of analyses at the end of this Chapter under **No. 408.**

The following section was measured at the above mine by the writer:

			Ft.	In.
Sandstone, medium-grained, visible			3	0
Shale, gray, plant fossils			0	6
Coal, bony	0'	6"		
Slate, dark	0	2		
Coal, medium-hard	3	2	3	10
Shale, gray			1	0

A. M. Barnett Coal Prospect—No. 409 on Map II.

On head of branch of Little Birch River, 1.1 miles N. 40° E. of Ramp Run P. O.; **Upper Kittanning Coal**; elevation, 1390' B.

			Ft.	In.
Coal, weathered (slate roof)	1'	6"		
Coal, soft	1	0	2	6
Coal, concealed				

Dr. Custis Coal Opening—No. 410 on Map II.

On south side of branch of Little Birch River, 1.1 miles N. 45° E. of Ramp Run P. O.; **Upper Kittanning Coal**; elevation, 1425' B.

			Ft.	In.
Sandstone, visible			5	0
Slate, bony, left up			1	0
Coal, semi-splint	1'	0"		
Coal, splinty (shale floor)	2	0	3	0

Dr. J. B. Gregg Custis Coal Opening—No. 411 on Map II.

On head of Little Birch River, 1.8 miles N. 45° W. of Erbacon; **Upper Kittanning Coal**; elevation, 1920' B.

			Ft.	In.
Sandstone, massive, gray, visible			10	0
Coal, splinty	0'	10"		
Coal, softer	1	8		
Coal, splint (shale floor)	2	2	4	8

The above opening is in Webster County about one mile from the Braxton Line, the coal from it having an excellent reputation for steam and domestic fuel.

Otter District, Braxton County.

In Otter District, the Upper Kittanning Coal lies entirely below drainage, except on the waters of Little Birch River, its stratigraphic position being shown in the sections given in Chapter IV for Sutton and Polemic Run, pages 94 and 73, respectively, and in the log of well No. 76 on Map II. As exhibited on Figure 8, its minable area appears to be confined to the southeast half of the District, since in the northwest portion it seems to be absent from most of the records obtained for oil and gas wells. The eight following openings in this coal, scattered throughout the southern portion of the District, were all examined by the writer:

Lewis Dunn Coal Opening—No. 412 on Map II.

At mouth of branch on north side of Long Run, 1.2 miles southwest of Canfield; Upper Kittanning Coal; elevation, 1060' B.

	Ft.	In.
Coal	1	6
Sandstone, shaly	5	6
Concealed	8	0
Sandstone, Lower Freeport	45	0
Concealed in bench	10	0

Ott Rader Coal Opening—No. 413 on Map II.

On a south branch of Long Run, 2.1 miles southwest of Canfield; Upper Kittanning Coal; elevation, 1070' B.; closed; reported 1' 6" thick.

A. J. Fugale Coal Opening—No. 414 on Map II.

On east hillside of Road Run of Little Birch River, ¼ mile northeast of Polemic Run; Upper Kittanning Coal; elevation, 1200' B.; opening closed by water; section as given by Currence Long, who once mined the coal here.

		Ft.	In.
Coal, medium-soft (shale roof)	1' 6"		
Shale, dark-gray, medium-hard, 3" to	1 3		
Coal, hard (slate floor)	0 10	3	7

Mr. J. F. Cobb is opening this bed up in a new place 100 feet south and had just got blossom at the date of the writer's visit.

Frank Davis Coal Opening—No. 415 on Map II.

On east edge of private hill road, ¼ mile southwest of Polemic Run; Upper Kittanning Coal; elevation, 1215′ B.; for stratigraphic position, see Section at Mouth of Polemic Run, Chapter IV, page 73.

	Ft.	In.
Sandstone, visible	6	0
Shale, dark, sandy, plant fossils	4	0
Coal, medium-soft, bright, as seen in little carload outside opening, closed, thickness reported	1	6

W. T. Harris Coal Opening—No. 416 on Map II.

On west hillside of Bear Run, 1.8 miles N. 70° W. of Little Birch P. O.; Upper Kittanning Coal; elevation, 1120′ B.

	Ft.	In.
Sandstone, massive, visible	5	0
Coal, splinty	1	2
Shale, dark, to bed of Bear Run	10	0

Frank Skidmore Coal Opening—No. 417 on Map II.

On east bank of Windy Run, 1.1 miles S. 45° W. of Tesla; Upper Kittanning Coal; elevation, 1185′ B.; closed; reported 1′ 6″ thick.

Coe Jenkins Coal Opening—No. 418 on Map II.

On east bank of Windy Run, 1.6 miles S. 40° W. of Tesla; Upper Kittanning Coal; elevation, 1200′ B.

	Ft.	In.
Sandstone, massive, visible	15	0
Shale, dark-blue, gray, plant fossils	8	0
Coal, opening closed, reported by Robert Jackson and Currence Long "peacock" color and a fine coal for all purposes with thickness of	1	6

The "peacock lustre" is characteristic of the Upper Kittanning Coal from the region of Sutton southwestward to Queen Shoals in western Clay County.

Jonathan Pierson Coal Opening—No. 419 on Map II.

On east side of hill road, head of Laurel Run, 2.8 miles S. 10° W. of Little Birch P. O.; Upper Kittanning Coal; elevation, 1630′ B.; closed; reported by Mr. Pierson as 2′ 0″ to 3′ 0″ thick.

Birch District, Braxton County.

In Birch District practically the same conditions prevail as regards the Upper Kittanning Coal in the northwest portion as in Otter, the apparent minable area, as shown on Figure 8, being confined to the southeast border on the waters of Little Birch River and Strange Creek. Its stratigraphic position is exhibited in the sections published in Chapter IV for Rosedale, Sleith—1.7 Miles Northeast, Twistville-Diatter Run, Herold—South Edge, Glendon, Strange Creek, Jennings—0.5 Mile West, and Jennings—0.4 Mile Southeast; in the log of well No. 79 on Map II; and in the records of Coal Test Borings Nos. 30 and 32, the two latter being used in the Glendon and Twistville-Diatter Run Sections, pages 86 and 83, respectively. The data on the three following diggings and exposures along Elk River were obtained by the writer:

Coal Exposure—No. 420 on Map II.

In bed of Elk River at Villa Nova; **Upper Kittanning Coal**; elevation, 765′ B.; section by J. M. Boggs of Big Otter, Clay County.

			Ft.	In.
Coal	0′	6″		
Shale, gray	0	6		
Coal	3	0	4	0

Troy Nottingham, a native, also reports the coal at the above digging to be 48 to 50 inches in thickness just below mouth of Duck Creek.

Coal & Coke Railway Co. Coal Exposure—No. 421 on Map II.

In Coal & Coke Railway cut, 0.3 mile northeast of Strange Creek Station; **Upper Kittanning Coal**; elevation, 805′ B.

			Ft.	In.
Coal (sandy shale roof)	0′	2″		
Fire clay shale	1	1		
Coal, splint (to shale floor)	0	9	2	0

Coal & Coke Railway Co. Coal Exposure—No. 422 on Map II.

In Coal & Coke Railway cut, 200 yards southwest of Strange Creek Station; **Upper Kittanning Coal**; elevation, 825′ B.

	Ft.	In.
Shale, sandy, buff, at base of great sandstone cliff	4	0
Coal, Upper Kittanning "Rider"	0	0½
Shale, dark	4	0
Sandstone, shaly	11	0
Shale, bluish-gray, with iron nodules, some 4″ in diameter	5	0
Coal 0′ 1″ Fire clay shale, gray 1 2 **Upper Kittanning** **Coal** 0 5	1	8
Fire clay shale	5	0
Sandstone to railroad grade	5	0

Compare the above with the Strange Creek Section, in Chapter IV, page 87.

The blossom of the Upper Kittanning Coal is exposed in road, 0.5 mile southeast of Strange Creek Station, at an elevation of 840′ B., about 40 feet above the Coal and Coke Railway grade, at **Coal Exposure No. 423 on Map II**, according to Gawthrop, who obtained the data at the two following exposures in the southern portion of Birch District:

Coal Prospect—No. 424 on Map II.

On east bank of Mill Run, 1.2 miles S. 5° E. of Strange Creek Station; **Upper Kittanning Coal**; elevation, 855′ B.

	Ft.	In.
Sandstone, massive, visible	20	0
Shale, gray, siliceous	5	0
Coal, concealed, reported	1	3
Shale	5	0
Sandstone, massive	5	0
Concealed to run	10	0

Coal Prospect—No. 425 on Map II.

At road fork, 0.4 mile S. 15° W. of Herold; **Upper Kittanning Coal**; elevation, 1105′ B.; coal, in road, prospect closed, should be 18″ to 24″ in thickness, as revealed in the Herold—South Edge Section, in Chapter IV, page 85.

Otter District, Clay County.

In Otter District, the Upper Kittanning Coal, in minable dimensions and regularity, appears to be confined to the southern half, as shown on Figure 8, its outcrop as given in detail on Map II being limited to the southern edge. Its thickness and stratigraphic position are exhibited in the sections given in Chapter IV for Mouth of O'Brien Creek and Ivydale; and in the log of the J. M. Boggs Coal Test Boring No. 39 on Map II—1.7 miles southeast of Big Otter P. O.—the details of which are published on pages 109, 110, and 473, respectively. In the southeast edge of the District, the three following openings were examined along the north hillside of Elk River:

G. W. Flenner Coal Opening—No. 426 on Map II.

On west hillside of Elk River, ½ mile south of Villa Nova; **Upper Kittanning Coal**; elevation, 825′ B.; opening closed; section by G. W. Flenner.

			Ft.	In.
Coal, soft (sandstone roof)	0′	8″		
Slate, black	0	1		
Coal, hard	3	0	3	9

John M. Duffield (Stone & Felty) Coal Opening—No. 427 on Map II.

On west hillside of Elk River, 1.0 mile south of Villa Nova; **Upper Kittanning Coal**; elevation, 860′ B.

			Ft.	In.
Sandstone, massive, brown, coarse, visible			6	0
Coal	0′	5″		
Shale, gray	0	2		
Coal, harder	0	9		
Shale, gray, fire clay	2	9		
Coal, hard	0	4	4	5
Concealed by water				

Coal Opening—No. 428 on Map II.

On west hillside of Elk River, 1¼ miles south of Villa Nova; **Upper Kittanning Coal**; elevation, 895′ B.; thickness not learned; elevation determined by hand-level across river.

The following description and section of the locally famous "O'Brien Creek Coal" are taken from Volume II(A), pages 563-4:

"At the mouth of O'Brien Creek on Elk River, two miles below the Clay-Braxton Line, a coal bed has been mined for local use at 90 to 100 feet above Elk River and has long been known as the **O'Brien Creek Coal.** It comes 200 feet below the top of a great pebbly cliff of sandstone, where the lowest red beds are still higher, and hence would most probably represent the **Roaring Creek bed, or No. 5 Block Coal.**"

Felty Brothers Coal Opening—No. 429 on Map II.

On south bank of branch of O'Brien Creek, 0.4 mile due north of mouth of the latter; **Upper Kittanning Coal**; elevation, 840′ B.

		Ft.	In.
1.	Sandstone, very pebbly, visible	20	0
2.	Concealed and massive sandstone	160	0
3.	**Coal, blossom, Upper Kittanning "Rider"**		
4.	Concealed	15	0
5.	Sandstone, massive	8	0
6.	Shale, dark, sandy, fossil plants	0	2
7.	**Coal, "O'Brien Creek," Upper Kittanning,** 5′ 8″ to	7	2
8.	Concealed	10	0
9.	Sandstone, very massive, current-bedded, **Upper East Lynn**	70	0
10.	**Coal, Middle Kittanning**	0	8
11.	Fire clay and sandy shales	5	0
12.	Sandstone to bed of Elk River	10	0

"This coal, No. 7, is quite irregular in thickness and the thick portion is evidently a 'pocket,' since at a point only 100 feet in from the entrance, the coal thins from 7′ 2″ to 5′ 8″ within 20 feet. The upper half of the coal is softer, and looks like an excellent coking bed, while the lower half is harder and holds some splinty layers."

The writer visited the above opening during 1915 and determined that the "O'Brien Creek" Coal without doubt represents the Upper Kittanning bed and is the same seam that belongs at practically 300 feet above the Kanawha Black Flint at Clay and Dorfee and at slightly over 200 feet above the same datum at Queen Shoals. The Mouth of O'Brien Creek Section, in Chapter IV, page 109, exhibits the true position of the bed.

In the southern edge of the same District (Otter), Gawthrop examined the 4 following openings:

Frank Hall Coal Prospect—No. 430 on Map II.

On north hillside of Elk River, ¼ mile west of mouth of O'Brien Creek; Upper Kittanning Coal; elevation, 925' B.

				Ft.	In.
Shale, gray, siliceous				5	0
Coal, concealed, opening closed, 3' 0" to				5	0
Concealed				10	0
Sandstone, massive, pebbly	15'	0"	Upper East Lynn	90	0
Concealed	5	0			
Sandstone, massive, pebbly	10	0			
Concealed	15	0			
Sandstone, massive, pebbly	45	0			

Sam. Braggs Coal Opening—No. 431 on Map II.

On west bank of Otter Creek, 1.5 miles N. 10° E. of Ivydale; Upper Kittanning Coal; elevation, 800' B.

	Ft.	In.
Sandstone, massive, hard, gray, Upper Freeport	40	0
Concealed	70	0
Sandstone, massive, Lower Freeport	15	0
Shale, dark	4	0
Coal, concealed, reported, Upper Kittanning	1	2
Sandstone, massive, hard, gray, to run	15	0

Franklin Hamrick Coal Opening—No. 432 on Map II.

On west hillside, 0.3 mile up Upper Two Run, just west of Ivydale; Upper Kittanning Coal; elevation, 980' B.

			Ft.	In.
Coal, soft (shale roof)	0'	9"		
Slate, coaly	0	4		
Coal	1	10		
Coal, slaty	0	7	3	6
Shale and concealed to No. 5 Block—Lower Kittanning Coal bench			120	0

W. W. Brannon Coal Opening—No. 433 on Map II.

On west hillside, 0.5 mile up Upper Two Run, just west of Ivydale; Upper Kittanning Coal; elevation, 990' B.

			Ft.	In.
Shale, visible			5	0
Slate, black			1	0
Coal, gas	0'	6"		
Slate	0	4		
Coal, splint	2	0		
Coal, concealed by water, about	1	0	3	10

Buffalo District, Clay County.

In Buffalo District, the Upper Kittanning Coal, in minable thickness and regularity, appears to be quite generally present, except where removed by erosion, as shown on Figure 8, its stratigraphic position being exhibited in the sections given in Chapter IV for Groves—1 Mile Southwest, Villa Nova—1.3 Miles South, Groves—1.2 Miles Southeast, Harrison—1.6 Miles East, and Sand Fork—¾ Mile Northeast. This bed has never been mined commercially within the District, but it has been prospected considerably by natives for local domestic fuel. The following opening, examined by both Gawthrop and the writer, is the same as that referred to by I C. White near the top of page 565 of Volume II(A) of the State Survey Reports, where it was wrongly correlated with the No. 5 Block bed as a glance at the sections in Chapter IV for Ivydale and Groves—1 Mile Southwest, pages 110 and 111, respectively, will readily show:

J. W. Bledsoe Coal Opening—No. 434 on Map II.

On south hillside of Elk River, at Ivydale, opposite mouth of Upper Two Run; Upper Kittanning Coal; elevation, 960' B.

			Ft.	In.
Shale, visible			5	0
Coal	0'	6"		
Bone	0	3		
Coal	1	0		
Coal, concealed, reported	1	6	3	3

In the northern border of the same District (Buffalo), the two following openings were examined by both Gawthrop and the writer:

Coal Opening—No. 435 on Map II.

On east hillside of Elk River, 0.6 mile S. 10° E. of Villa Nova; Upper Kittanning Coal; elevation, 840' B.; opening closed in ravine; no information obtained as to thickness; natives did not know; comes directly on top of grayish-white, pebbly cliff, absolutely same sandstone as crops just above river at Strange Creek.

William Callison Coal Opening—No. 436 on Map II.

On east bank of Frame Run, 1.4 miles due east of Groves; Upper Kittanning Coal; elevation, 855′ B.; section by Gawthrop.

				Ft.	In.
1.	Shale, brownish-gray, visible			5	0
2.	Coal, gas	0′	5″		
3.	Sandstone, shaly	1	0		
4.	Coal, gas	1	4		
5.	Coal, soft	0	10		
6.	Bone	0	1		
7.	Coal, splint	1	1		
8.	Coal, gas	1	2	5	11
9.	Slate and concealed			3	0
10.	Sandstone, massive, gray, hard, to run			5	0

The analysis of a sample (172G) collected by Gawthrop from Nos. 4, 5, 7, and 8 of the above section, as reported by Messrs. Hite and Krak, is given under **No. 436** in the table of coal analyses at the end of this Chapter:

The writer also measured a section at the above opening, as follows:

			Ft.	In.
Coal blossom, Upper Kittanning "Rider," not seen here but visible near by			0	6
Sandstone, shaly, flaggy			15	0
Shale, sandy, dark, fossil plants abundant			5	0
Coal, gas, medium-hard	0′	4½″		
Fire clay shale, sandy, hard	0	10		
Coal, gas, medium-hard	2	2		
Bone	0	1		
Coal, splint, hard, bright	1	1		
Coal, gas, medium-hard	1	4	5	10½
Slate and concealed to Frame Run			7	0

The following measurements by Dr. I. C. White are taken from Volume II(A), page 564, of the Survey Reports, the same being verified by the writer in 1915:

Henry Waggy Coal Opening—No. 437 on Map II.

On south hillside of Elk River, 0.5 mile northeast of Groves; Upper Kittanning Coal; elevation, 915′ B.

	Ft.	In.
Concealed and sandstone from top of knob	160	0
Sandstone, pebbly, big cliff, Upper Freeport	50	0
Concealed	40	0
Fire clay and coal horizon, Upper Kittanning "Rider"		

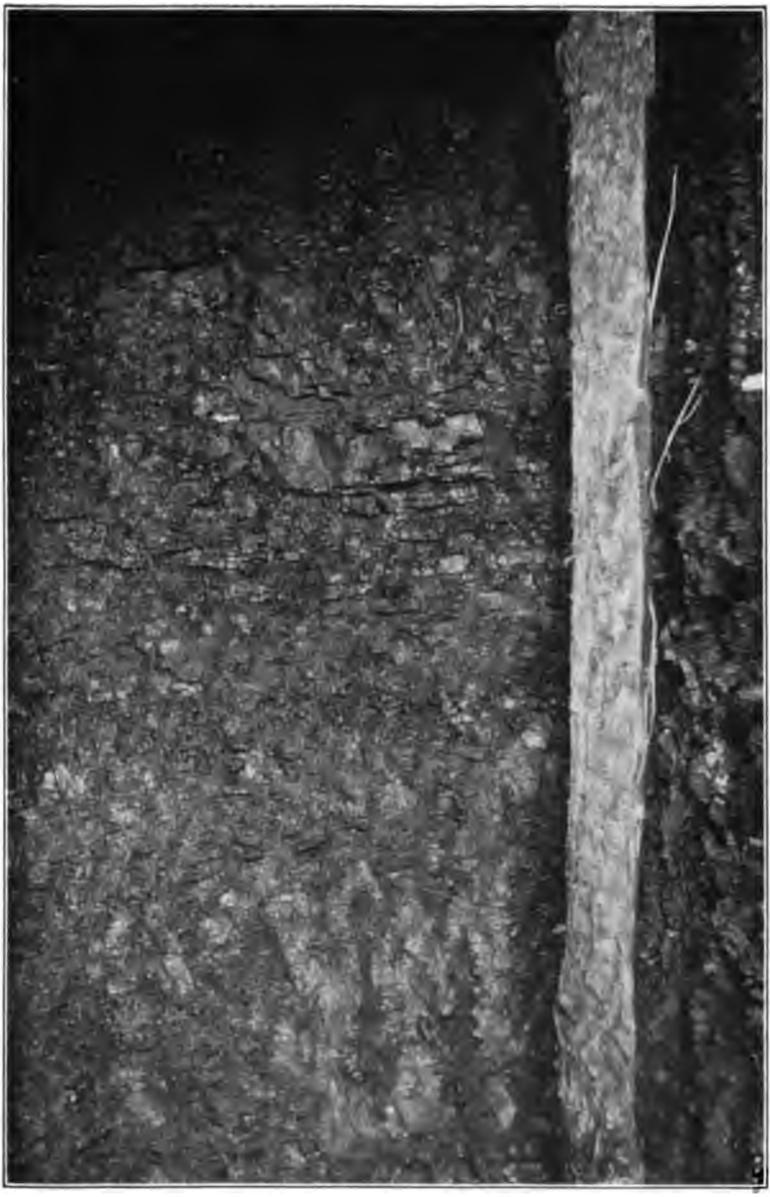

PLATE XXII.—Showing bed structure of Middle Kittanning Coal at Prospect Opening No. 540 on Map II. (See page 618.)

		Ft.	In.
Concealed		10	0
Shales, sandy		15	0
Sandstone, massive		5	0
Shales, soft, gray		3	9
Coal, slaty		0	3
Shale, and sandy fire clay		0	11
Shale, dark		0	3
Coal ..... 3' 4"	Upper Kittanning	6	0
Slaty cannel 0 7			
Shale, bluish 0 3			
Slate, black 0 1			
Coal, splinty 1 9			
Concealed		10	0
Sandstone, Upper East Lynn, massive, pebbly in lower half, visible		60	0
Concealed to Elk River		80	0

The coal has been correlated with the Upper Kittanning for reasons given on preceding pages under the discussion of Openings Nos. 429 and 434 in the same bed.

In the same general region of Buffalo District, the 5 following openings were examined by Gawthrop:

Henry Waggy Coal Opening—No. 438 on Map II.

On north hillside of Groves Creek, 0.3 mile east of Groves; Upper Kittanning Coal; elevation, 970′ B.; closed, reported about 3′ 6″ thick.

Henry Waggy Coal Prospect—No. 439 on Map II.

On west hillside of Groves Creek, 0.7 mile southeast of Groves; Upper Kittanning Coal; elevation, 975′ B.; sandstone, massive cliff, and concealed; prospect, on bench, closed; 5 feet above sandstone.

T. J. Young Coal Opening—No. 440 on Map II.

On west hillside of Groves Creek, 1.2 miles southeast of Groves; Upper Kittanning Coal; also examined by the writer; elevation, 980′ B.

	Ft.	In.
Sandstone, massive, brown, pebbly, Upper Freeport	25	0
Concealed to bench	40	0
Concealed	60	0
Coal, opening closed, reported by Mr. Young	2	6
Concealed, with sandstone, to Middle Kittanning bench	60	0

Jesse Young Coal Prospect—No. 441 on Map II.

In a west branch of Laurel Fork, 2.5 miles S. 30° W. of Groves; Upper Kittanning Coal; elevation, 985′ B.

			Ft.	In.
Shale, dark-gray, with plant fossils, visible			4	0
Coal, gas	0′	2″		
Shale, gray, hard, siliceous	1	5		
Coal, gas	1	0	2	7
Shale			1	0
Sandstone to run			15	0

Dr. Brockerhoff Coal Prospect—No. 442 on Map II.

In branch of Root Fork, 2.1 miles N. 85° E. of Harrison; Upper Kittanning Coal; elevation, 1020′ B.

			Ft.	In.
Sandstone, massive, visible			10	0
Shale, dark-gray			2	0
Coal, gas	0′	2″		
Shale, gray, siliceous	1	0		
Coal, gas (shale floor)	1	4	2	6

In the same District (Buffalo), the 3 following openings were examined by the writer:

Coal Opening—No. 443 on Map II.

On west hillside of Groves Creek, 1.6 miles east of Harrison; Upper Kittanning Coal; elevation, 1055′ B., opening closed, thickness not learned; for stratigraphic position, see Section 1.6 Miles East of Harrison, page 114.

Coal Opening—No. 444 on Map II.

On west bank of Cow Run, 1.3 miles southeast of Harrison; Upper Kittanning Coal; elevation, 1065′ B.; coal, thickness not learned, opening closed.

Elk River Coal & Lumber Co. Coal Opening—No. 445 on Map II.

On south hillside of Rockcamp Run, 1.5 miles southeast of Harrison; Upper Kittanning Coal; elevation, 1095′ B.

			Ft.	In.
Coal, slightly bony, visible	0′	5″		
Shale, gray, hard	0	4		
Coal, gas, hard (gray slate floor)	3	9	4	6

In the extreme southern corner of Buffalo District, Gawthrop obtained the following data at an opening in this coal:

Coal Opening—No. 446 on Map II.

On head of Dog Run, 0.3 mile northeast of Enoch P. O.; Upper Kittanning Coal; elevation, 1530′ B.

	Ft.	In.
Concealed from bench, Lower Freeport Coal horizon	30	0
Sandstone, Lower Freeport, massive, brownish-gray, pebbly	38	0
Concealed	10	0
Coal, Upper Kittanning, concealed, reported	2	2
Concealed to sandstone, East Lynn, massive, white, hard	10	0

Henry District, Clay County.

In Henry District, the Upper Kittanning Coal, in minable dimensions and regularity, is fairly persistent throughout the most of the area, as shown on Figure 8, the bed generally ranging in thickness from 18 to 48 inches, its stratigraphic position being exhibited in the sections given in Chapter IV for Ivydale—0.5 Mile Southwest, Whetstone, and Clay. Although never mined commercially, it has been prospected extensively by natives for local domestic fuel. The data for the following opening is given on the authority of H. B. Davenport:

Coal Opening—No. 447 on Map II.

On east side hill road, 0.4 mile southwest of Maysel; **Upper Kittanning Coal**; elevation, 1040′ B.; coal, 3′ 0″ to 4′ 0″ thick.

The data on the 7 following openings in Henry District north of Elk River were obtained by the writer:

Grover Mullins Coal Opening—No. 448 on Map II.

On south hillside of Laurel Fork of Laurel Creek, 0.8 mile west of Maysel; **Upper Kittanning Coal**; elevation, 1015′ B.

	Ft.	In.
Shale, dark, sandy, plant fossils abundant; excellent place to collect plant fossils; many species of ferns, calamites, etc	5	0
Coal, semi-splint, bright, hard	2	0
Slate, black, pavement		

Ben. Davis Coal Opening—No. 449 on Map II.

On south hillside of branch of Blue Knob Creek, ⅛ mile southeast of Blue Knob; **Upper Kittanning Coal**; elevation, 1070' B.

			Ft.	In.
Coal, semi-splint (dark shale roof)	0'	10 "		
Slate, black, ¼" to	0	0⅛		
Coal, semi-splint, harder (slate floor)	1	8	2	6⅛

The coal from above mine has a great reputation as domestic fuel and is reported the best in neighborhood.

Ben. Davis Coal Opening—No. 450 on Map II.

On north edge of road, ¼ mile northwest of Opening No. 449 above; **Upper Kittanning Coal**; elevation, 1040' B.; closed; thickness not learned.

William Payne Coal Opening—No. 451 on Map II.

On north hillside of Elk River, 0.7 mile N. 30° W. of Elkhurst; **Upper Kittanning Coal**; elevation, 1060' B.

	Ft.	In.
Sandstone, coarse, brown, pebbly, visible, **Lower Freeport**	30	0
Coal, semi-splint, medium-hard	2	0
Slate and concealed	290	0
Kanawha Black Flint		

Coal Opening—No. 452 on Map II.

On west edge of hill road, in sharp bend, 2.2 miles N. 70° E. of Elkhurst; **Upper Kittanning Coal**; elevation, 1080' B.; closed; thickness not learned.

Coal Opening—No. 453 on Map II.

On west edge of hill road, 1.5 miles S. 5° W. of Maysel; **Upper Kittanning Coal**; measured with hand-level; elevation, 1105' B.

	Ft.	In.
Coal, opening closed, **Upper Kittanning "Rider"**, not much over	1	0
Shale and concealed	10	0
Sandstone	5	0
Shale	4	0
Coal, semi-splint, **Upper Kittanning**	1	6
Fire clay shale	10	0

William Claxton Coal Prospect—No. 454 on Map II.

On south hillside of Lower Two Run, 1.0 mile S. 35° E. of Maysel; **Upper Kittanning Coal**; elevation, 1035′ B.; coal, semi-splint, hard, visible (with shale floor) 1′ 0″; not driven in to full height of coal.

The data for the following opening, ¾ mile northeastward in Henry District, are given on the authority of H. B Davenport:

Coal Opening—No. 455 on Map II.

On west hillside of branch of Lower Two Run, 1.1 miles S. 80° E. of Maysel; **Upper Kittanning Coal**; elevation, 1030′ B.; section by H. B. Davenport; coal, 3′ 0″ to 4′ 0″ thick.

On the northwest side of Elk River at Clay, the writer examined the following opening:

James Reed Coal Opening—No. 456 on Map II.

On head of run on north side of Elk River, 0.9 mile N. 60° W. of Dundon; **Upper Kittanning Coal**; elevation, 1000′ B.; closed; reported by Solomon Reed 3′ 0″ thick.

On the south side of Elk River in Henry District, the writer obtained the data at the four following openings:

Coal Opening—No. 457 on Map II.

On south hillside of Elk River at Clay, 0.8 mile southwest of Dundon; **Upper Kittanning Coal**; elevation, 1055′ B.; section by C. L. Voglesang, Manager, Elliott Splint Coal Co., of Pisgah, W. Va.; coal, bright, mines in small cubical blocks, semi-splint, 2′ 0″ to 2′ 6″ thick.

The heavy blossom of the Upper Kittanning Coal was found by the writer on the south hillside of Elk River at Clay, 0.5 mile southwest of Dundon, at an elevation of 1080′ B., at **Opening No. 458 on Map II,** as shown in the Section for Clay, in Chapter IV, page 129. The latter shows the Upper Kittanning Coal—Kanawha Black Flint interval to be about 300 feet.

William Stephenson Coal Opening—No. 459 on Map II.

On east hillside of Cove Hollow, 2.7 miles southeast of Clay, and 0.6 mile N. 40° W. of Cove Hollow School; **Upper Kittanning Coal**; elevation, 1160′ B.; closed; **reported** by C. L. Voglesang, clean, hard, bright, semi-splint, with thickness of 3′ 10″.

James Blankenship Coal Opening—No. 460 on Map II.

On northwest edge of trail, 1.5 miles S. 45° W. of Cressmont; **Upper Kittanning Coal**; elevation, 1265′ B.; opening closed; bright-black, hard, gas type; comes 5 to 10 feet above grayish-white **East Lynn Sandstone**, the conglomerate pebbly portion showing 40 feet below the coal; thickness **reported** 3′ 0″ to 5′ 0″.

In the extreme eastern corner of Henry District, the following opening was examined by Gawthrop:

William Kyle Coal Opening—No. 461 on Map II.

On head of Dog Run, at Enoch P. O.; **Upper Kittanning Coal**; elevation, 1545′ B.

			Ft.	In.
Shale, dark-gray, from sandstone			5	0
Slate			0	6
Coal, gas	1′	0″		
Mother **coal**, 0′ 1″ to	0	0		
Coal, gas, harder (shale floor)	1	1	2	1

Slightly less than 2 miles southeastward, the writer examined the following opening:

J. D. Acree Coal Opening—No. 462 on Map II.

In edge of Nicholas County, west side of road, 1¾ miles S. 15° E. of Enoch; **Upper Kittanning Coal**; elevation, 1790′ B.

			Ft.	In.
Fire clay shale, gray, plant fossils abundant			4	6
Coal, hard, gas	0′	5″		
Shale, gray, 0″ to	0	2		
Coal, hard, gas (slate floor)	1	11	2	6

The coal from this mine has an excellent reputation as a domestic fuel.

Pleasant District, Clay County.

In Pleasant District, the Upper Kittanning Coal occurs in practically the same development as described for Henry, its minable area, except where cut out by erosion, covering the entire District, as shown on Figure 8. Its stratigraphic position is given in the sections in Chapter IV for Dorfee and Lizemores—1.3 Miles South, given in Chapter IV, and in the logs of Coal Test Borings Nos. 45A, 45B, and 45C, published on preceding pages of this Chapter. Its outcrop is usually high up on the hill and ridge slopes as exhibited in detail on Map II. It has never been mined commercially but it has been opened at many points by natives for local domestic fuel, maintaining its great reputation in this respect.

The details at **Coal Opening—No. 463 on Map II,** on south hillside of Elk River at Dorfee; **Upper Kittanning Coal**; elevation, 1105′ B., are published with the Dorfee Section, page 146. Coal from this opening was once tested for coking purposes with the following results, according to Henry Brooke, General Manager, Dorfee Coal Mining Company, as published in Volume II(A), page 442, of the Survey Reports:

Coal.		Coke.	
Moisture	1.00	Volatile Matter	0.31
Volatile Matter	40.00	Fixed Carbon	91.40
Fixed Carbon	54.60	Ash	8.26
Ash	4.40	Sulphur	0.80
		Phosphorus	0.016
Total	100.00		
Sulphur	0.70		

Slightly over a mile eastward in Pleasant District, Gawthrop examined the following opening in this bed:

Charles Thomas Coal Opening—No. 464 on Map II.

On south hillside of Elk River, 0.6 mile S. 75° E. of Elkhurst; Upper Kittanning Coal; elevation, 1140′ B.

			Ft.	In.
Sandstone, flaggy, visible			5	0
Coal, gas	1′	1″		
Slate	0	1		
Coal, semi-splint	2	8	3	10
Shale and concealed			5	0
Sandstone, Upper East Lynn, massive, gray, hard, pebbly			30	0

Southward in the same District, the writer examined the two following exposures:

Charles Thompson Coal Opening—No. 465 on Map II.

On east hillside of Little Beechy Creek, 1.7 miles southeast of Elkhurst; **Upper Kittanning Coal**; rises rapidly to east in 150 feet; elevation, 1140′ B.

		Ft.	In.
Sandstone, visible		4	0
Shale, dark-gray, 0″ to		0	10
Coal, semi-splint	0′ 10″		
Slate, 0′ to	0 1		
Coal, semi-splint (slate floor)	1 4	2	3

Coal Exposure—No. 466 on Map II.

On east hillside of Little Sycamore Creek, ¼ mile due south of Warfield; **Upper Kittanning Coal**; elevation, 1225′ B.; coal reported at spring on bench, at base of pebbly sandstone.

Coal Opening—No. 467 on Map II.

On west hillside of Lick Branch of Adonijah Fork, 1.6 miles S. 50° W. of Warfield; **Upper Kittanning Coal**; elevation, 1220′ B.; section reported by H. B. Davenport; coal, 3′ 0″ to 4′ 0″ thick.

The 7 following openings on the Upper Kittanning Coal, scattered in Pleasant District, were examined by Gawthrop:

Samuel Jones Coal Opening—No. 468 on Map II.

In edge hill road, 1.6 miles N. 75° W. of Lizemores; **Upper Kittanning Coal**; elevation, 1230′ B.; section as reported by Mr. Jones.

		Ft.	In.
Coal (shale roof)	3′ 0″		
Slate	1 0		
Coal (to slate floor)	0 10	4	10

Homer Morton Coal Opening—No. 469 on Map II.

On west hillside of Adonijah Fork, 1.2 miles S. 80° W. of Lizemores; **Upper Kittanning Coal**; greatest rise, S. 70° W.; elevation, 1230′ B.

		Ft.	In.
Sandstone, visible		5	0
Coal, gas	1′ 2″		
Coal, gas, harder (shale floor)	1 4	2	6

G. M. Jones Coal Opening—No. 470 on Map II.

On east hillside of Adonijah Fork, due east of mouth of Bull Hollow; **Upper Kittanning Coal**; bed rises S. 70° E. for 200 feet and then drops same direction; elevation, 1210′ B.

			Ft.	In.
Coal, gas (shale roof)	1′	2″		
Coal, gas, harder	1	5		
Shale, gray	2	6		
Coal (slate floor)	0	9	5	10

R. W. Morton Coal Opening—No. 471 on Map II.

On north hillside of Bull Hollow, 0.9 mile east of Crosby; **Upper Kittanning Coal**; elevation, 1250′ B.

			Ft.	In.
Coal, gas (shale roof)	1′	4″		
Coal, gas, harder	1	6		
Shale, reported	1	6		
Coal, reported (shale floor)	1	0	5	4

G. W. Morton Coal Opening—No. 472 on Map II.

On south side of road on Bull Hollow, 1.2 miles east of Crosby; **Upper Kittanning Coal**; elevation, 1275′ B.

			Ft.	In.
Shale, siliceous, visible			5	0
Coal, gas	1′	4″		
Coal, gas, harder	1	6		
Shale, reported	1	0		
Coal, reported	1	0	4	10

J. C. Stone Coal Opening—No. 473 on Map II.

On east side of hill road, 1.2 miles due south of Lizemores; **Upper Kittanning Coal**; also examined by the writer; elevation, 1340′ B.

				Ft.	In.
1.	Shale, gray, roof			0	8
2.	Coal, gas	1′	2″		
3.	Coal, gas, harder	1	5	2	7
4.	Shale and concealed			5	0

The analysis of a sample (171G) collected by Gawthrop from Nos. 2 and 3 of above section, as reported by Messrs. Hite and Krak, is given under No. 473 in the table of coal analyses at the end of this Chapter.

The coal in above section is hard, bright, and approaches a semi-splint.

Caleb Sizemore Coal Opening—No. 474 on Map II.

On west hillside of Open Fork, 1.8 miles N. 15° E. of Scotford; **Upper Kittanning Coal**; elevation, 1340′ B.

	Ft.	In.
Shale, visible	5	0
Coal, concealed, (shale floor), reported	2	10

In the southern edge of Pleasant District, the writer examined the two following openings:

C. Sizemore Coal Opening—No. 475 on Map II.

On east hillside of Open Fork, 1.7 miles N. 25° E. of Scotford; **Upper Kittanning Coal**; elevation, 1365′ B.; coal, in run on east side of road; reported "extra-fine coal" with a thickness of 3′ 0″ to 4′ 0″.

Ward Coleman Coal Opening—No. 476 on Map II.

On head of branch of Sangamore Fork, 1.6 miles N. 35° E. of Scotford; **Upper Kittanning Coal**; elevation, 1395′ B.

	Ft.	In.
Shale, dark-gray, visible	3	0
Coal, gas, medium-hard; coal on dump has a bright-black appearance with charcoal laminations and peacock lustre, giving it the name "peacock" coal (shale floor)	2	6

In the extreme southwest edge of the same District (Pleasant), Gawthrop obtained the following data at two exposures:

The blossom of the **Upper Kittanning Coal** is exposed in trail on east hillside of Rockcamp Fork of Bells Creek, 1.0 mile S. 10° E. of Bird Knob, at an elevation of 1215′ B., as reported by Gawthrop, at **Exposure No. 477 on Map II.**

J. Q. Dickinson Coal Opening—No. 478 on Map II.

On northeast hillside of Rockcamp Fork of Bells Creek, ¾ mile S. 15° W. of Bird Knob; **Upper Kittanning Coal**; elevation, 1215′ B.

	Ft.	In.
Shale, visible	5	0

			Ft.	In.
Coal, gas	1'	8"		
Cannel bone	0	4		
Coal, gas, hard	1	4		
Shale	0	4		
Coal, semi-splint	0	6		
Shale, gray	0	4		
Coal, semi-splint (shale floor)	2	2	6	8

The 5 following openings in the southeast portion of Pleasant District were examined by the writer:

Coal Opening—No. 479 on Map II.

On head of Road Fork, 1.0 mile N. 35° W. of Greendale; **Upper Kittanning Coal**; elevation, 1365' B.; coal, on north edge of road, 10' by hand-level above Lackawanna Coal & Lumber Co. No. 2 well (134); opening closed, but estimated by props about 3' 0" thick.

Eldridge Coleman Coal Opening—No. 479A on Map II.

On east hillside of Sangamore Fork, 0.7 mile N. 70° W. of Greendale; **Upper Kittanning Coal**; elevation, 1430' B.

			Ft.	In.
Shale, dark, sandy, plant fossils abundant, visible			4	0
Coal, bony, cannel	0'	2"		
Coal, gas, hard (slate floor)	3	0	3	2

The bed is reported as being 4 feet thick at some points in the above opening.

Price Coal Opening—No. 480 on Map II.

On head of Big Hollow, 2½ miles S. 80° E. of Lizemores; **Upper Kittanning Coal**; elevation, 1425' B.; coal, opening closed; but reported by Mr. P. N. Stone with "peacock" lustre; coal still more oily than on Calvin Fork; comes on bench immediately above **Upper East Lynn Sandstone**; reported having a thickness of 3' 0" to 3' 6".

Reuben Neal Coal Opening—No. 481 on Map II.

On east side of Sycamore Creek, 0.6 mile due east of mouth of Right Fork; **Upper Kittanning Coal**; elevation, 1260' B.; closed; reported by Mr. Richard Brown as having a thickness of 3' 0".

Coal Exposure—No. 482 on Map II.

In ridge road, 1.6 miles N. 70° E. of Indore P. O.; **Upper Kittanning Coal**; elevation, 1280′ B.; **coal blossom**, in road, heavy, bed 3′ 0″ to 4′ 0″.

The data at the two following openings are given on the authority of Mr. M. McD. Price:

Coal Opening—No. 483 on Map II.

On south hillside, ¼ mile southwest of mouth of Cottrill Fork of Middle Creek; **Upper Kittanning Coal**; elevation, 1250′ B.; **coal**, 2′ 0″.

Coal Opening—No. 484 on Map II.

On south hillside of Elk River, ½ mile south of mouth of Leatherwood Creek; **Upper Kittanning Coal**; elevation, 1110′ B.; **coal**, 3′ 8″ thick.

Union District, Clay County.

In Union District, the Upper Kittanning Coal occurs in practically the same development as in Pleasant, its thickness and stratigraphic position being shown in the sections given in Chapter IV for Queen Shoals, King, and Bomont—1 Mile Northwest; and in the logs of the following test wells for oil and gas, the numbers corresponding to their designation on Map II and in the Table of Wells for Clay County, pages 346-9:

152
153
154
155
158
165
167
169
170
170
178
182
183
185
189
197
200
202
208
214
231
232
242

The only commercial mine in either county that ever operated this bed is located at Queen Shoals where it has erroneously been correlated with the No. 5 Block Coal in former State Survey Reports[1], since the detailed work of the writer in Braxton and Clay during 1915 and in Fayette County during 1916 proves beyond doubt that the latter bed belongs 125 to 200 feet lower in the measures at an interval above the Kanawha Black Flint ranging from 60 to 70 feet at Montgomery (Fayette)—the type locality of the No. 5 Block—to slightly over 100 feet in southeastern Clay County. This is corroborated by the sections mentioned above in addition to those given in Chapter IV for Bomont—1 Mile Due East, Dorfee, Clay, Ivydale, Twistville-Diatter Run, and Palmer.

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[1] I. C. White, Vol. II(A), pp. 530-2; 1908; and C. E. Krebs, Kanawha County Report, pp. 438-440; 1914.

The Upper Kittanning Coal has been prospected extensively by natives for local domestic fuel in Union District, the two following openings in that portion north of Elk River having been examined by Gawthrop:

Brown & Goshorn Coal Opening—No. 485 on Map II.

On southeast hillside of Upper King Shoals Run, 0.5 mile northeast of King; **Upper Kittanning Coal**; elevation, 830' B.

		Ft.	In.
Sandstone, visible		5	0
Coal, semi-splint	0' 4"		
Coal, gas	1 8	2	0
Shale and concealed		25	0
Sandstone		10	0
Concealed		10	0
Sandstone, shaly		5	0

Brown & Goshorn Coal Opening—No. 486 on Map II.

On north hillside of Elk River, opposite King; **Upper Kittanning Coal**; elevation, 845' B.; see King Section, Chapter IV, page 155.

		Ft.	In.
Sandstone, massive, medium-coarse, brown		10	0
Concealed		22	0
Sandstone, massive, brown, coarse		15	0
Coal	0' 3"		
Shale, gray	0 5		
Coal, semi-splint	1 0		
Coal, gas, hard	1 5	3	1
Slate and concealed		25	0
Sandstone, massive		10	0

The 6 following openings are from commercial mines in the immediate region of Queen Shoals, none of which was in operation in the latter part of 1915:

Queen Shoals Coal Co. Mine—No. 487 on Map II.

On south side of Elk River, ¼ mile northeast of Queen Shoals Station; Upper Kittanning Coal; examined by the writer; elevation, 845′ L.

	Ft.	In
Coal, mine abandoned, thickness 3′ 0″ to.......	4	0

Queen Shoals Coal Co. Mine—No. 488 on Map II.

On point, 0.4 mile S. 5° E. of Queen Shoals Station; Upper Kittanning Coal; examined by Gawthrop; elevation, 845′ L.

	Ft.	In.
Shale and concealed..	6	0
Coal, (Queen Shoals), Upper Kittanning, mine not running for about a year, 3′ 0″ to.......	4	0
Sandstone, grayish-white, hard, pebbly, Upper East Lynn................................	20	0

The above was the last of the operations to shut down in this region, the suspension being caused by the tipple washing away in flood and not since rebuilt.

Claybrook Mining Co. Mine—No. 489 on Map II.

In Kanawha County, north hillside of Elk River, 0.4 mile north of Queen Shoals Station; Upper Kittanning Coal; data from page 438 of Kanawha County Report; elevation, 815′ B.; mine abandoned.

			Ft.	In.
Coal (sandstone roof)..............	1′	6″		
Bone	0	2		
Coal, block (fire clay floor).........	2	4	4	0

"The capacity of mine is 100 to 200 tons per day."

The above mine was not in operation in 1915.

Queen Shoals Coal Co. Mine—No. 490 on Map II.

On south hillside of Elk River, 0.5 mile west of Queen Shoals Station; Upper Kittanning Coal; examined by the writer; elevation, 815′ L.; mine abandoned.

			Ft.	In.
Coal, splinty, Upper Kittanning "Rider"........			1	3
Sandstone, shaly............................			6	0
Slate, dark, good roof..........................			5	0
Coal, splint, bright.................	1′	6″		
Slate, gray, hard....................	0	1		
Coal, splint, hard (slate floor)......	2	8	4	3

"Butts, N. 30° E.; faces, S. 60° E.; greatest rise, S. 60° E.; mine capacity, 100 tons; men employed, 50; coal shipped north, west, and northwest for steam and domestic purposes; authority for mine data, H. H. Davis, Superintendent."

The above data are mostly taken from pages 530-1 of Volume II(A). The coal at this mine was once sampled by S. D. Brady, and the analysis as determined by Prof. Hite and assistants and published on page 287 of Volume II, is given in the table at the end of this Chapter under **No. 490.**

At the above mine, a **slaty cannel** often appears in the bottom of the coal, especially in connection with "rolls". The writer once collected a sample of it for analysis, the results of which, as reported by Messrs. Hite and Patton and published on page 531 of Volume II(A), are as follows:

Proximate.		Ultimate.	
Moisture	0.70	Carbon	71.50
Volatile Matter	39.35	Hydrogen	4.75
Fixed Carbon	46.02	Oxygen	7.78
Ash	13.93	Nitrogen	1.24
		Sulphur	0.80
Total	100.00	Ash	13.93
Sulphur	0.80		
Phosphorus	0.007	Total	100.00
Calorimeter B. T. U.	13,073	Calculated B. T. U.	12,763

Princess Coal Co. Mine—No. 492 on Map II.

On west hillside of Left Fork, 0.7 mile southeast of Queen Shoals Station; **Upper Kittanning Coal**; examined by Gawthrop; elevation, 870' B.; mine abandoned.

			Ft.	In.
Coal, semi-splint (sandstone roof)	1'	9"		
Shale	0	1		
Coal, splint (shale floor)	2	0	3	10

Queen Shoals Coal Co. Prospect No. 493 on Map II.

On west hillside of Left Fork, 1.1 miles southeast of Queen Shoals Station; **Upper Kittanning Coal**; examined by Gawthrop and the writer; elevation, 905' B.

			Ft.	In.
Coal, semi-splint (shale roof)	2'	0"		
Slate	0	1		
Coal, splint (shale floor)	1	11	4	0

The 5 following openings in the western portion of Union District were examined by Gawthrop:

L. D. Graham Coal Opening—No. 491 on Map II.

On Harts Branch, 1.1 miles east of Queen Shoals Station; **Upper Kittanning Coal**; elevation, 915′ B.; opening closed, thickness not learned.

Monroe Young Coal Opening—No. 494 on Map II.

On west bank of Left Fork, 1.7 miles southeast of Queen Shoals Station; **Upper Kittanning Coal**; elevation, 940′ B.

	Ft.	In.
Bench, Lower Freeport Coal horizon	10	0
Concealed, steep slope	80	0
Concealed	21	0
Coal, Upper Kittanning, concealed, reported	3	6

J. M. Page Coal Opening—No. 495 on Map II.

On branch of Queen Shoals Creek, 2.7 miles S. 40° E. of Queen Shoals Station; **Upper Kittanning Coal**; elevation, 970′ B.

		Ft.	In.
Sandstone, massive, visible		5	0
Shale, gray, 1′ 0″ to		2	0
Coal, semi-splint	1′ 0″		
Coal, splint (shale floor)	1 6	2	6

James Page Coal Opening—No. 496 on Map II.

In a west branch of Porter Creek, 0.7 mile west of Bomont; **Upper Kittanning Coal**; elevation, 955′ B.; closed; **reported** 2′ 8″ thick.

The above opening is reported to have a 1-inch slate parting near the center of the seam. The bed overlies a massive gray sandstone, and 90 feet above the coal is the massive, pebbly **Upper Freeport Sandstone.**

P. S. Hart Coal Opening—No. 497 on Map II.

On north side of hill road, 0.7 mile northwest of Bomont; **Upper Kittanning Coal**; elevation, 945′ B.; closed; **reported** 3′ 0″ thick.

The following opening was examined by both Gawthrop and the writer:

Okey Samples Coal Opening—No. 498 on Map II.

On east side of hill road, 1.2 miles north of Bomont; Upper Kittanning Coal; elevation, 930′ B.

	Ft.	In
Shale, dark-brown	5	0
Coal, gas, 1′ 6″ to	2	0
Shale, gray	8	0

Coal Opening—No. 499 on Map II.

On branch of Camp Creek, 1.3 miles N. 20° E. of Bomont; Upper Kittanning Coal; examined by Gawthrop; elevation, 905′ B.

			Ft.	In.
Shale, dark, siliceous			8	0
Fire clay shale			2	0
Coal, gas	0′	11″		
Shale, gray	0	4		
Coal, splint (shale floor)	1	0	2	3

The 7 following openings are mostly on the waters of Porter Creek in Union District:

Ralph King Coal Prospect—No. 500 on Map II.

In a west branch of Porter Creek, 0.6 mile N. 5° W. of Odessa; Upper Kittanning Coal; examined by Gawthrop; elevation. 940′ B.; prospect closed; section as reported by David King.

			Ft.	In.
Coal, hard (shale roof)	1′	0″		
Slate, hard, gray or black	0	2		
Coal	2	6	3	8
Shale, gray, to sandstone, massive, hard, gray			6	0

Mr. King reports a seam of coal (Upper Kittanning "Rider") of poor quality 10 to 15 feet above this opening.

L. A. Samples Coal Opening—No. 501 on Map II.

On branch of Porter Creek, 0.6 mile due west of Odessa; Upper Kittanning Coal; examined by Gawthrop; elevation, 995′ B.; coal dips S. 40° E., but may be just a local one.

			Ft.	In.
Sandstone, massive, visible			6	0
Shale			2	0
Coal, semi-splint	2′	1″		
Shale, gray	0	9		
Coal (shale floor)	0	3	3	1

Coal Opening—No. 502 on Map II.

On south edge of road on Wade Fork, 1.4 miles S. 70° W. of Shelton; Upper Kittanning Coal; examined by the writer; elevation, 1012' L.

			Ft.	In.
Shale, gray			3	0
Coal	1'	1"		
Shale	0	2		
Coal	1	3	2	6
Shale and concealed to run and top of massive gray sandstone			5	0

Burrell McComas Coal Opening—No. 503 on Map II.

On west side of Porter Creek, 0.6 mile north of Glen; Upper Kittanning Coal; examined by Gawthrop; elevation, 1045' B.; opening closed; section as reported by a native.

			Ft.	In.
Shale, dark, visible			5	0
Coal	2'	6"		
Shale	1	0		
Coal (to slate floor)	0	9	4	3

D. P. Taylor Coal Opening—No. 504 on Map II.

On east hillside of Porter Creek, ¾ mile northeast of Glen; Upper Kittanning Coal; butts, N. 70° W.; faces, N. 20° E.; examined by Gawthrop; elevation, 1055' B.

			Ft.	In.
Sandstone, visible			5	0
Coal, gas, hard	1'	4"		
Coal, semi-splint	1	6	2	10

J. E. Jeffery Coal Opening—No. 505 on Map II.

On east hillside of Porter Creek, 1.3 miles southeast of Odessa; Upper Kittanning Coal; examined by Gawthrop; elevation, 1035' B.

			Ft.	In.
Sandstone, massive, roof				
Coal, hard, gas	1'	2"		
Coal, semi-splint	1	6	2	8
Shale and concealed			5	0
Sandstone, massive, visible			25	0

S. M. Mullens Coal Opening—No. 506 on Map II.

On west hillside of Porter Creek at Glen; **Upper Kittanning Coal**; examined by Gawthrop; elevation, 1080' B.; closed; thickness not learned.

The 3 following openings in the western edge of Union District, on the waters of Falling Rock Creek, were examined by Gawthrop:

Coal Opening—No. 507 on Map II.

On east hillside of Falling Rock Creek, 1.5 miles N. 50° W. of Glen; **Upper Kittanning Coal**; examined by Gawthrop; elevation, 1055' B.; closed; reported 2' 6" thick.

Coal Prospect—No. 508 on Map II.

On east hillside of Falling Rock Creek, 1.0 mile N. 75° W. of Glen; **Upper Kittanning Coal**; elevation, 1070' B.; closed; reported 2' 0" thick.

Coal Exposure—No. 509 on Map II.

In hill road of Falling Rock Creek, 0.6 mile S. 85° W. of Glen; **Upper Kittanning Coal**; elevation, 1080' B.; coal blossom, in road, 1' 0" visible.

The above blossom occurs 50 feet under the top of a massive sandstone (Lower Freeport) of which 15 feet is visible.

The 5 following openings in the southern portion of Union District were examined by Gawthrop:

Clay Lumber Co. Coal Opening—No. 510 on Map II.

On east hillside of Porter Creek, ¼ mile southeast of Glen; **Upper Kittanning Coal**; elevation, 1120' B.

			Ft.	In.
Sandstone, massive, visible			10	0
Shale, dark, siliceous			5	0
Coal, weathered	2'	4"		
Shale, dark-gray	1	6		
Coal (slate floor)	0	9	4	7

Coal Opening—No. 511 on Map II.

On north hillside of Spruce Fork, edge of road, 1.0 mile S. 15° E. of Glen; **Upper Kittanning Coal**; elevation, 1170′ B.; closed; thickness not learned.

Albert Dunham Coal Opening—No. 512 on Map II.

On west side of branch of Spruce Fork, 1.2 miles S. 35° E. of Glen; **Upper Kittanning Coal**; elevation, 1205′ B.

			Ft.	In.
Shale, dark-gray			2	0
Coal, gas	1′	0″		
Coal, gas, hard, or semi-splint	1	6		
Slate, 0′ 4″ to	0	2		
Coal, gas, 0′ 11″ to	0	8	3	4
Slate and concealed			5	0
Sandstone, **Upper East Lynn**, massive, gray, hard			15	0
Concealed			40	0
Sandstone, massive, gray, visible			10	0

Lee Young Coal Opening—No. 513 on Map II.

On south hillside of Left Fork, ½ mile west of Spruce Low Gap; **Upper Kittanning Coal**; elevation, 1220′ B.

			Ft.	In.
Shale, siliceous, visible			5	0
Sandstone, shaly			2	0
Coal, gas, hard	1′	0″		
Coal, gas, harder, or semi-splint	1	6		
Shale, dark-gray	0	7		
Coal	1	1		
Slate, coal streaks	0	6	4	8
Shale, bluish-gray, visible			2	0

Philip Sizemore Coal Opening—No. 514 on Map II.

On head of branch of Right Fork, 0.9 mile S. 20° W. of Spruce Low Gap; **Upper Kittanning Coal**; elevation, 1235′ B.

			Ft.	In.
Coal, gas (shale roof)	1′	2″		
Coal, gas, harder	1	8		
Shale, reported	1	3		
Coal, reported	1	0	5	1
Shale to run			1	0

In the same region of Union District, the 3 following openings were examined by the writer:

Clay Lumber Co. Coal Opening—No. 515 on Map II.

On head of Little Sycamore Creek, 1.6 miles due west of Warfield; **Upper Kittanning Coal**; elevation, 1205′ B.

			Ft.	In.
Sandstone, massive, visible			8	0
Coal, semi-splint, bright	2′	3″		
Bone, hard	0	3		
Coal, semi-splint (slate floor)	1	4	3	10

The above prospect comes 130 to 140 feet above another in the No. 5 Block bed, ¾ mile southeastward on the north bank of Little Sycamore Creek.

Hiram Samples Coal Opening—No. 516 on Map II.

On east hillside of Wade Fork, 0.4 mile northwest of Opening No. 515 above; **Upper Kittanning Coal**; elevation, 1185′ B.

	Ft.	In.
Sandstone		
Shale, 2′ 0″ to	0	0
Coal, semi-splint, hard (slate floor)	2	8

William Samples Coal Opening—No. 517 on Map II.

On west side of Wade Fork, 1.1 miles S. 85° E. of Glen; **Upper Kittanning Coal**; elevation, 1155′ B.

	Ft.	In.
Shale, sandy, bluish-gray, visible	5	0
Coal, semi-splint, hard (slate floor)	2	10

Slightly over 2 miles northeastward in Union District (Clay County), the following prospect was examined by Gawthrop:

Goshorn Coal Prospect—No. 518 on Map II.

On north hillside, ¼ mile up Open Hollow of Little Sycamore Creek; **Upper Kittanning Coal**; elevation, 1080′ B.

	Ft.	In.
Shale, siliceous, visible	10	0
Coal, concealed, prospect would indicate about	4	0

Quantity of Upper Kittanning Coal Available.

Based on the evidence given on preceding pages and a planimetric determination by Tucker of the area from Map II as limited on Figure 8, the following estimate is made for the probable amount of Upper Kittanning Coal available in the territory of this Report:

Probable Amount of Upper Kittanning Coal.

Counties by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Braxton:					
Salt Lick.......	2.5	39.00	24,960	2,718,144,000	108,725,760
Otter	2.5	42.05	26,912	2,930,716,800	117,228,672
Birch	2.0	22.50	14,400	1,254,528,000	50,181,120
Holly	3.0	36.80	23,552	3,077,775,360	123,111,014
Totals		140.35	89,824	9,981,164,160	399,246,566
Clay:					
Otter	2.0	15.50	9,920	864,230,400	34,569,216
Buffalo	2.0	41.65	26,656	2,322,270,720	92,890,828
Henry	2.5	64.25	41,120	4,477,968,000	179,118,720
Pleasant	3.0	27.20	17,408	2,274,877,440	90.995,097
Union	3.0	33.70	21,568	2,818,506,240	112,740,250
Totals		182.30	116,672	12,757,852,800	510,314,111
Totals for Both Counties...		322.65	206,496	22,739,016,960	909,560,677

MIDDLE KITTANNING COAL.

The Middle Kittanning Coal, as limited in this Report, is described briefly in Chapter VII, page 241. It is a valuable deposit of fuel in southern Clay County and over most of the shaded area designated as minable on Figure 9 below. In the northwest half of each county, it appears to be absent entirely as a separate and distinct minable seam. In the southeast portions of Salt Lick, Holly, and Otter Districts, Braxton, it is frequently present from a few inches to 25 feet above the Lower Kittanning bed, but usually carries more or less slate and bony material, rendering it of doubtful commercial value. By a liberal use of the tables of intervals in Chapter III, pages 26-28, in conjunction with the structure contours on Map II, the approximate position of the coal can be determined at any point. It has never been mined commercially in either county, but it has been prospected considerably by natives and the large land-holding companies, especially in southern Clay. In the latter region, it belongs about 100 feet below the Upper Kittanning bed; 75 feet above the No. 5 Block seam; and 175 feet above the Kanawha Black Flint. The results of investigations by the writer along the

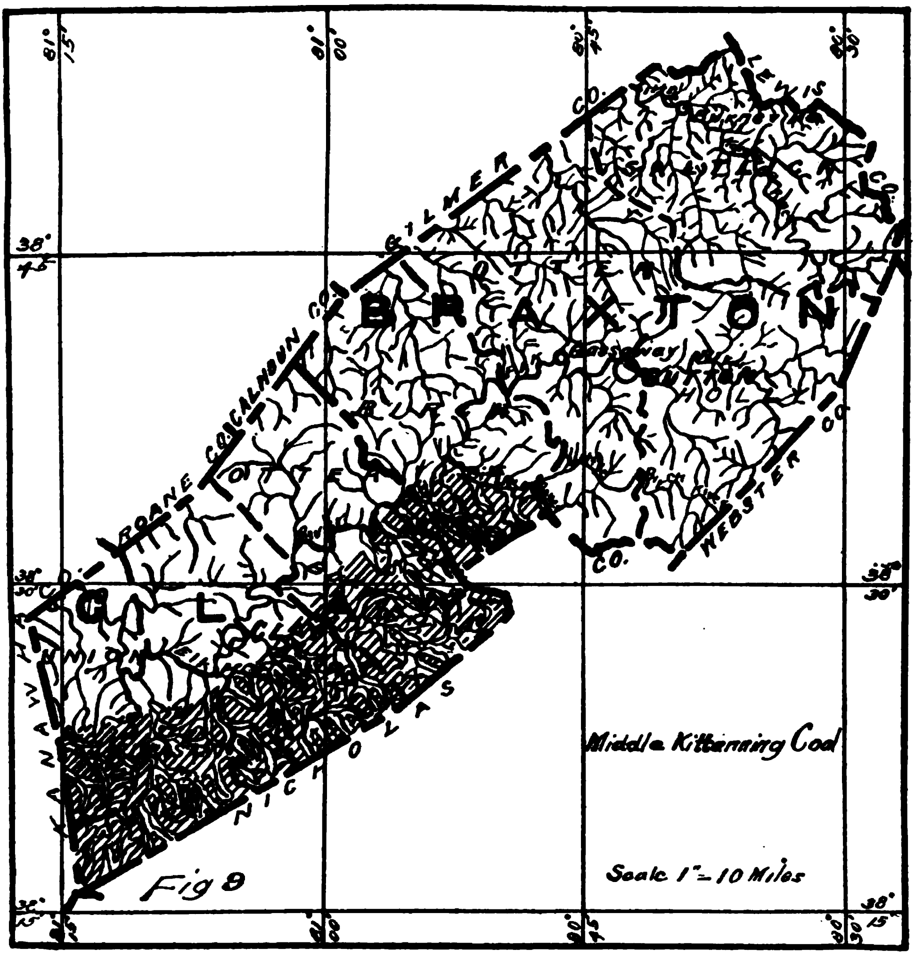

Figure 9.—Map Showing Approximate Minable Area of Middle Kittanning Coal (See Explanations in Author's Preface).

Kanawha Valley in Kanawha and Fayette Counties, during 1916, places it beyond reasonable doubt at the horizon of the **North Coalburg Coal.** Its thickness and character at crop exposures and prospect openings will now be described by magisterial districts:

Salt Lick District, Braxton County.

In Salt Lick District, the Middle Kittanning Coal does not appear to attain sufficient thickness, purity, and regularity as a distinct bed to class it as minable. Its stratigraphic position, in the immediately adjoining Counties of Lewis and Webster, is exhibited in the Cleveland Section, pages 58-59.

In the southeastern edge of Salt Lick District, Gawthrop examined the following prospect:

Coal Prospect—No. 519 on Map II.

On west side of hill road on Pretty Creek, 1.0 mile northwest of Wildcat; Middle Kittanning Coal; elevation, 1180′ B.

				Ft.	In.
Coal, prospect (No. 519) closed, Middle Kittanning, reported				2	0
Sandstone, East Lynn				21	5
Coal, hard	0′	6″	Lower Kittanning (Lewis Holden Opening—No. 556 on Map II).	3	7
Coal, bony	0	3			
Coal, hard	0	9			
Slate, black	0	1			
Coal, good, medium-hard	2	0			
Slate					

Holly District, Braxton County.

In Holly District, the thickness and stratigraphic position of the Middle Kittanning Coal are exhibited in the sections given in Chapter IV for Palmer and Little Birch—1.3 Miles Southeast, pages 97 and 106, respectively; and in the log of Coal Test Boring No. 38 on Map II—located on Wolf Creek—the details of which are published on page 470. Its thickness at **Coal Opening No. 520 on Map II** on the north hillside of Elk River, 0.8 mile due north of the mouth of Holly River, is shown in the Palmer Section last mentioned. This opening was once operated by the West Virginia Midland

Railroad Company for use in its locomotives, according to data published by I. C. White on page 522 of Volume II(A) of the State Survey Reports. A sample of coal was collected here for analysis, excluding the slate and bone, and the results, as published on page 523 of the Report last mentioned, are given under **No. 520** in the table of coal analyses at the end of this Chapter.

According to the same reference, a sample of this coal was coked by the Elkins Coal and Coke Company, at its plant on Deckers Creek, near Morgantown, Monongalia County, West Virginia, and Mr. J. W. Knowlton, the chemist for that Company, reported the following analyses of both the coal and coke:

	Coal.	Coke.
Volatile Matter	35.04	1.22
Fixed Carbon	56.88	85.24
Ash	8.08	13.54
Totals	100.00	100.00
Sulphur	0.98	0.85
Phosphorus	.....	0.017

All the foregoing tests reveal a high-grade coal, the calorimetric results running much higher than that obtained for the No. 5 Block bed in the Widen region and in southern Clay County, a feature that is largely due to its much lower oxygen content as shown in the ultimate analyses.

In the same District (Holly), the two following prospects in what appears to be the Middle Kittanning bed were examined by Gawthrop:

Dr. J. B. Gregg Custis Coal Prospect—No. 521 on Map II.

In a west branch of Left Fork of Wolf Creek, 1.9 miles N. 45° E. of Ramp Run P. O.; Middle Kittanning Coal; elevation, 1355′ B.

	Ft.	In.
Sandstone, massive, medium-grained, visible	10	0
Shale, gray	2	0
Coal, concealed (loose lumps of hard splinty coal in run), thickness not learned		

Coal Prospect—No. 522 on Map II.

In a north branch of Little Birch River, 1.0 mile N. 30° E. of Ramp Run P. O.; Middle Kittanning Coal; elevation, 1350′ B.

			Ft.	In.
Shale, dark, visible			3	0
Coal, slaty	1'	0"		
Slate, gray	1	0		
Slate, coaly	0	6		
Coal (slate floor)	1	3	3	9

The above opening belongs only 50 feet here below the Upper Kittanning Coal at Openings Nos. 409 and 410 on Map II, described on preceding pages of this Chapter.

Otter District, Braxton County.

In Otter District, the stratigraphic position of the Middle Kittanning Coal is shown in the section given in Chapter IV for Mouth of Polemic Run, page 73. Judging from the crop exposures observed at many points and the logs of several borings, this coal does not appear to attain minable dimensions and regularity. The two following exposures were examined by the writer in the southeastern portion of the District:

Coal Exposure—No. 523 on Map II.

In road on point, opposite mouth of Laurel Run of Little Birch River; **Middle Kittanning Coal**; elevation, 1160' B.

	Ft.	In.
Fire clay shale, dark, trace of coal in top	5	0
Sandstone, great cliff, **East Lynn**		

Coal Exposure—No. 524 on Map II.

In road on point, 0.8 mile N. 55° E. of Herold; **Middle Kittanning Coal**; elevation, 1010' B.; fire clay and trace of coal on top of **East Lynn Sandstone**, grayish-white.

Birch District, Braxton County.

In Birch District, the Middle Kittanning Coal appears to be very irregular in its development, its thickness and stratigraphic position being shown in the sections given in Chapter IV for Twistville-Diatter Run, Herold—Northeast, Herold—South Edge, Glendon, and Jennings—½ mile West. The logs of Coal Test Borings Nos. 30 and 32 on Map II, used in connection with the Twistville-Diatter Run and Glendon Sections, show the true position for this seam as its correlation is assumed southward and westward to the Nicholas and Kanawha County Lines, the interval between it and the No. 5 Block bed gradually increasing in the same directions to a maximum of slightly less than 100 feet.

The three following exposures in that portion of the District south of Elk River were examined by the writer:

Coal Opening—No. 525 on Map II.

On south bank of Strange Creek, 1.5 miles southeast of Strange Creek Station; **Middle Kittanning Coal**; elevation, 855′ B.

	Ft.	In.
Sandstone, grayish-white, **Upper East Lynn**.....	40	0
Shale, flaggy, sandy.....	4	0
Shale, dark-gray, plant fossils abundant.........	1	0
Coal, gas, medium-hard, (slate floor)...........	2	4

Coal Exposure—No. 526 on Map II.

At road fork, mouth of Frame Run of Strange Creek; **Middle Kittanning Coal**; elevation, 860′ B.; **coal** blossom, heavy, 2′ 6″ to 3′ 0″

Andy Woods Coal Opening—No. 527 on Map II.

On south hillside of Strange Creek, ¼ mile northwest of Jennings; **Middle Kittanning Coal**; elevation, 910′ B.

	Ft.	In.
Shale, sandy, flaggy, visible.....................	8	0
Coal, splint, hard (slate floor).................	0	10

Otter District, Clay County.

In Otter District, the Middle Kittanning Coal is very scanty in its occurrence, but its horizon is clearly indicated in the section given in Chapter IV for the Mouth of O'Brien Creek, page 109, the latter showing a slight increase in the thickness of the East Lynn Sandstone intervening between this coal and the underlying No. 5 Block bed—a feature in harmony with the statement given above under the description of the Middle Kittanning Coal in Birch District.

Buffalo District, Clay County.

In Buffalo District, the Middle Kittanning Coal begins to assume some economic importance, since it appears to be this bed that has been prospected for local domestic fuel on the waters of Groves Creek. Its thickness and stratigraphic position are exhibited in the sections given in Chapter IV for Groves—1.2 Miles Southeast, Harrison—1.6 Miles East, Root Fork of Groves Creek, Plum Run of Groves Creek, and Eakle —¾ Mile Southeast. In the Widen region, this bed has not apparently been prospected to any extent, although there is a distinct bench in the topography—60 to 80 feet above the No. 5 Block seam—corresponding with the top of the East Lynn Sandstone. The coal, if present, must be more or less irregular in thickness, since the conglomeratic Upper East Lynn Sandstone frequently rests unconformably upon the East Lynn ledge, as strikingly shown in the knob one-half mile due east of Eakle.

The four following exposures and prospects in the coal in question are all within Buffalo District:

Coal Exposure—No. 528 on Map II.

In Coal & Coke Railway cut, 1.0 mile S. 5° E. of Villa Nova; **Middle Kittanning Coal**; elevation, 805′ B.; examined by the writer.

	Ft.	In.
Coal blossom, visible	0	6
Fire clay shale	6	0
Sandstone, grayish-white, to railroad grade	7	0

The above exposure belongs 55 to 60 feet below the Upper Kittanning Coal.

At **Coal Exposure No. 529 on Map II,** on east hillside of Groves Creek, 1.1 miles southeast of Groves Station; **Middle Kittanning Coal**; elevation, 915′ B.; examined by the writer; **coal,** reported 12 inches thick.

Dr. Brockerhoff Coal Opening—No. 530 on Map II.

On east bank, ¼ mile up Root Branch of Groves Creek; **Middle Kittanning Coal**; elevation, 955′ B.; examined by Gawthrop.

			Ft.	In.
Coal, flaky (sandstone roof)	0'	5"		
Coal, slaty	0	3		
Coal, flaky	0	6		
Coal, gas to semi-splint	1	6	2	8
Shale and concealed to run			5	0

Coal Prospect—No. 531 on Map II.

On east bank of Groves Creek, 1.6 miles east of Harrison; **Middle Kittanning Coal**; elevation, 975′ B.; examined by Gawthrop; coal, opening closed; thickness not learned, but probably about the same as at No. 530.

Henry District, Clay County.

In Henry District, or the immediately adjoining portion of it, the thickness and stratigraphic position of the Middle Kittanning Coal are shown in the sections given in Chapter IV for Barton—1.5 Miles Southeast, Clay, and Morocco—2 Miles South, pages 124, 129, and 147, respectively. On the waters of Leatherwood Creek, it has been prospected quite extensively, and, with its included slates, frequently attains a thickness of 8 feet, coming about 100 feet below the Upper Kittanning bed, 75 to 90 feet above the No. 5 Block seam and 175 to 200 feet above the Kanawha Black Flint. As shown on Figure 9, its approximate minable area is confined to the southeastern portion of the District, and it seems to thin away northwestward as Elk River is approached, a feature largely due to the coalescing of the Upper East Lynn and East Lynn Sandstones.

Its thickness and position in the measures at the **Hannah Wyant Heirs Opening—No. 532 on Map II**—located on the west bank, 0.2 mile up Summers Fork of Laurel, 5 miles northwest of Clay, are shown in the Barton—1.5 Miles Southeast Section, page 124.

The following exposure in the same District was examined by Gawthrop:

Coal Exposure—No. 533 on Map II.

On head of Webb Branch of Lilly Fork, 5 miles S. 30° E. of Clay; **Middle Kittanning Coal**; elevation, 1325′ B.

	Ft.	In.
Sandstone, **East Lynn**, massive, pebbly	5	0
Concealed	10	0
Sandstone, very pebbly	10	0
Concealed	70	0
Sandstone	10	0
Coal, slaty, 1' 0" to	1	6
Concealed to run	10	0

The above exposure belongs about 110 feet below the Upper Kittanning Coal horizon.

Previous to 1915, the Elliott Splint Coal Company had had a number of prospect openings made in the Middle Kittanning, No. 5 Block, Stockton, and Coalburg Coal beds, along the valley walls of Leatherwood Creek southeastward from the vicinity of Right Fork, under the direction and supervision of Mr. C. E. Krebs, formerly Assistant Geologist on the State Survey Staff. Mr. C. L. Voglesang, General Manager of the Company mentioned, kindly furnished the Survey the tracing accompanying Mr. Krebs' report on the property, on which the detailed sections of the several beds at these prospect openings are shown, thus enabling the writer to supply this important item for many of the openings which were so closed in 1915 that the beds could not be measured. Wherever the latter condition prevailed, Mr. Krebs' section is published and due credit given for the same, not only for the Middle Kittanning Coal, now being described, but also for the prospects in the No. 5 Block bed.

The four following prospects were examined by the writer:

Elliott Splint Coal Co. Prospect—No. 534 on Map II.

On south hillside of Leatherwood Creek, 0.2 mile east of mouth of Right Fork; **Middle Kittanning Coal**; section by C. E. Krebs; elevation, 1135' B.

			Ft.	In.
Coal (shale roof)	0'	4"		
Slate	0	5		
Coal	1	9		
Slate	0	2		
Coal (slate floor)	2	4½	5	4½

The above prospect was poorly exposed when visited by the writer.

Recently the above prospect has been opened and driven in 50 to 60 feet, according to C. L. Voglesang, who reports the following section at the face:

			Ft.	In.
Coal (slate roof)	0'	5"		
Slate	0	4		
Coal (slate floor)	4	0	4	9

Elliott Splint Coal Co. Prospect—No. 536 on Map II.

On east hillside of Leatherwood Creek, 0.9 mile northwest of mouth of Road Fork; Middle Kittanning Coal; elevation, 1285' B.; section by C. E. Krebs.

			Ft.	In.
Coal, (shale roof)	0'	4"		
Slate	0	8		
Coal	1	11		
Slate	0	1		
Coal	2	3		
Slate	0	10		
Coal	0	5		
Slate	0	1		
Coal (slate floor)	0	7	7	2

Recently the above prospect has been opened and driven back 50 to 60 feet, according to C. L. Voglesang. who reports the following section at the face:

			Ft.	In.
Coal (slate roof)	1'	3 "		
Bone	0	1		
Coal	1	3		
Cannel	0	3		
Bone	0	1½		
Coal	1	4	4	3½

On the south side of Leatherwood, 110 feet straight up the hill above **Prospect No. 685 on Map II** in the No. 5 Block bed, the Middle Kittanning Coal has recently been opened at **Prospect No. 536A on Map II,** at an elevation of 1310' B., according to C. L. Voglesang, who reports the following section:

			Ft.	In.
Coal, (slate roof)	0'	5"		
Slate	1	8		
Coal	1	8		
Slate	0	3		
Coal	1	2	5	2

Elliott Splint Coal Co. Prospect—No. 537 on Map II.

On east hillside of Leatherwood Creek, 0.4 mile due north of mouth of Road Fork; Middle Kittanning Coal; elevation, 1390′ B.; examined by the writer; section of coal by C. E. Krebs.

			Ft.	In.
Sandstone, coarse, brown, Lower Freeport			65	0
Concealed and shale			25	0
Sandstone, coarse-grained, white and brown, large quartz pebbles, Upper East Lynn			70	0
Concealed and shale			15	0
Coal	0′	9½″		
Slate	0	2¼		
Coal	3	3		
Slate	0	5		
Coal (slate floor)	0	7	5	2¾

Recently the above prospect has been driven back 50 to 60 feet, according to C. L. Voglesang, who reports the following section at the face:

			Ft.	In.
Coal (slate roof)	1′	5 ″		
Shale, dark-gray	0	2½		
Coal	1	5		
Slate	0	1		
Coal	2	3		
Slate	0	4		
Coal (slate floor)	0	4	6	0½

Elliott Splint Coal Co. Prospect—No. 535 on Map II.

On north hillside of Leatherwood Creek, 0.8 mile east of mouth of Road Fork; Middle Kittanning Coal; elevation, 1485′ B.; bed section by C. E. Krebs.

			Ft.	In.
Coal (shale roof)	2′	0″		
Slate	0	4		
Coal	2	6		
Slate	0	1		
Coal	0	3		
Slate	1	5		
Coal (slate floor)	3	4	9	11

There is a marked resemblance in bed section between that above and **Prospect No. 687 on Map II**, as shown on a subsequent page under the description of the No. 5 Block bed in Henry District, yet the latter prospect is absolutely 75 to 80 feet lower in the measures.

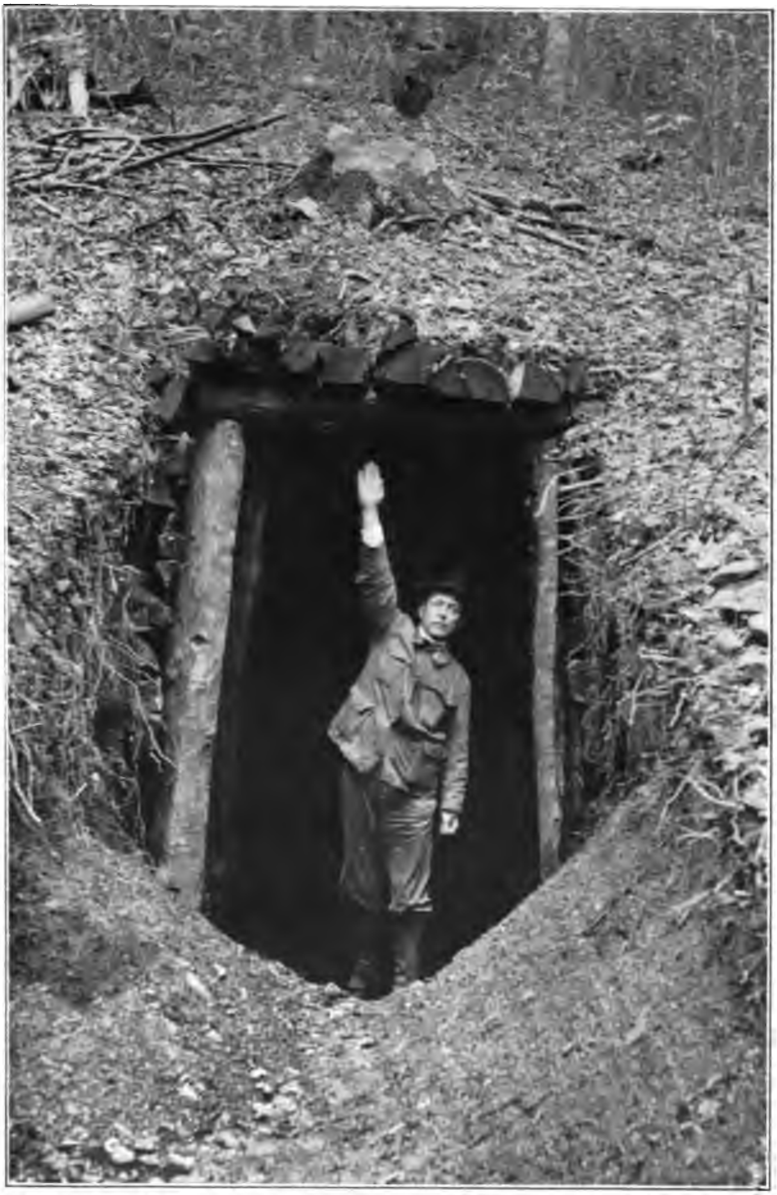

PLATE XXIII.—Showing comparative height of Middle Kittanning Coal at Prospect Opening No. 541 on Map II. (See page 619.)

MU

Recently the above prospect has been opened and driven in 50 to 60 feet at the face of which C. L. Voglesang reports the following section:

			Ft.	In.
Coal (slate roof)	2'	6"		
Bone	0	2		
Coal	2	6		
Slate	0	1		
Coal	0	3½		
Slate	1	7		
Coal	0	4		
Bone	0	2		
Coal (slate floor)	2	6	10	1½

Pleasant District, Clay County.

As in Henry, the Middle Kittanning Coal has been prospected extensively in Pleasant District by the natives and corporations, especially the Hartland Colliery Company on Middle Creek waters. Its thickness and stratigraphic position are exhibited in the section given in Chapter IV for Morocco —2 Miles South, page 147, as shown at **Hartland Colliery Co. Prospect—No. 538 on Map II**—located on the west hillside of Leatherwood Creek, 1.1 miles northwest of the mouth of Right Fork, its position being practically the same as that mentioned above for Henry District. Here it seems to attain the best uniform development observed in either county and on Middle Creek should furnish a very large tonnage of high-grade coal. The three following prospect openings on what is now the property of the Hartland Colliery Company were examined by the writer:

Hartland Colliery Co. Coal Prospect—No. 539 on Map II.

On west hillside of Leatherwood Creek, due west of mouth of Right Fork; Middle Kittanning Coal; elevation, 1142' L.

			Ft.	In.
Sandstone, great cliff, Upper East Lynn, estimated			40	0
Concealed			30	0
Shale			4	0
Coal, slaty	0'	1"		
Shale, gray	1	7		
Coal, semi-splint	1	8		
Bone splint	0	1		
Coal, splint (slate pavement)	2	1	5	6

The above opening comes 190 to 200 feet above the outcrop of the Kanawha Black Flint as determined by the writer.

Hartland Colliery Co. Coal Prospect—No. 540 on Map II.

On west hillside of Right Fork of Leatherwood Creek, just above mouth of Cannel Coal Hollow; **Middle Kittanning Coal**; elevation, 1170′ B.

			Ft.	In.
Sandstone, grayish-white, conglomerate, makes great cliff, **Upper East Lynn**			75	0
Concealed, steep slope			45	0
Shale, gray, not well exposed			1	3
Coal, slaty	0′	4″		
Coal, splint, blocky	3	2		
Cannel coal	0	2		
Coal, splint, blocky	1	0		
Bone	0	2		
Coal, splint, blocky (sandstone floor)	3	4	8	2

The above opening belongs 180 feet above the Kanawha Black Flint and 80 feet above the bench for the No. 5 Block Coal as this bench was accurately traced 0.8 mile southwestward to **Prospect Openings Nos. 698 and 697A on Map II** in the latter coal, by the writer, a feature, in addition to many other forms of stratigraphic evidence, that shows absolutely that the thick Middle Kittanning Coal of this region represents a separate and distinct seam from the No. 5 Block bed.

The following section of the **Middle Kittanning Coal** was mailed the writer by C. E. Krebs, of Charleston, West Virginia, on July 20, 1917, as having been measured by him:

Middle Creek Coal & Coke Co. Mine—No. 540A on Map II.

In Pleasant District, Clay County, east side of Middle Creek, ⅛ mile north of mouth of Lick Branch; **Middle Kittanning Coal**; elevation, 1175′ L.

			Ft.	In.
Coal	3′	2″		
Bone	0	2		
Coal	0	8		
Slate	0	1		
Coal	1	11	6	0

The composition of a sample collected by Mr. Krebs at the above opening and forwarded with the section, as reported by

Messrs. Hite and Krak under laboratory No. 238-K, is published in the table of analyses at the end of this Chapter under **No. 540A.**

Hartland Colliery Co. Coal Prospect—No. 541 on Map II.

On south hillside, ¼ mile southwest of mouth of Cottrill Fork of Middle Creek; Middle Kittanning Coal; elevation, 1117′ L.

			Ft.	In.
Coal, gas, medium-hard, visible	0′	6½″		
Coal and slate mixed	0	5		
Fire clay shale, gray	0	3		
Coal, bony	0	5		
Coal, semi-splint, medium-hard	2	2		
Bone	0	8		
Coal, splint (slate floor)	3	7	8	0½

The fine quality of the coal is shown by the following analysis of a sample collected at the above prospect opening by McClellan Leonard, of Uniontown, Pennsylvania, the results of which, as determined by the French-Pancoast Laboratories of New York City, and kindly furnished the Survey by M. McD. Price, Vice-President, Hartland Colliery Company, are as follows, the slates, of course, being omitted from the sample:

	Per cent.
Moisture	2.48
Volatile Matter	37.92
Fixed Carbon	50.68
Ash	8.95
Total	100.03
Sulphur	0.75

According to information furnished in December, 1916, by Mr. G. J. Alstetter, Chief Engineer of the Hartland Colliery Company, the Middle Kittanning Coal occurs in practically the same development in recent prospect openings on Middle Creek as those just described, the number on Map II, location, and spirit-level elevation of which are given in the table next below:

List of Recent Prospects in Middle Kittanning Coal.

No. on Map II.	Location in Pleasant District	Elevation—Feet above sea-level by spirit-level.
541A	On point, west hillside of Middle Creek, 0.3 mile north of Cottrill Fork................	1100
541B	On point, east hillside of Middle Creek, 1.4 miles south of Hartland..................	1086
541C	On east hillside of Middle Creek, ½ mile northeast of mouth of Cottrill Fork......	1122
541D	In branch, east hillside of Middle Creek, 0.3 mile northeast of mouth of Lick Branch...	1189
541E	In branch, east hillside of Middle Creek, ½ mile southeast of mouth of Lick Branch....	1193
541F	In branch, east hillside of Middle Creek, south of road, 1 mile southeast of mouth of Lick Branch..........................	1185

Southwestward in Pleasant District on the waters of Sycamore Creek, the following opening was examined by the writer:

Coal Opening—No. 541G on Map II.

On west hillside of branch of Sycamore Creek, 0.6 mile S. 50° W. of mouth of Big Hollow; **Middle Kittanning Coal**; elevation, 1255′ B.

		Ft.	In.
Sandstone, visible..............................		3	0
Fire clay shale, plant fossils....................		0	8
Coal, splinty, slightly bony.........	2′ 10″		
Coal, splint, hard (shale floor)....	2 2	5	0

The above opening belongs about 200 feet above the Kanawha Black Flint and about 250 feet above the Coalburg Coal, cropping low down on the valley walls of Sycamore Creek. This is the only opening observed in Pleasant District away from the waters of Middle Creek, but it probably occurs in fair development southwestward to the Kanawha County Line, since it undoubtedly represents the famous "North Coalburg" bed of the latter area.

Union District, Clay County.

In Union, the Middle Kittanning Coal in minable thickness and regularity appears to be confined to the southern portion of the District. Its thickness and stratigraphic position are exhibited in the logs of oil and gas well borings Nos. 163, 175, 180, 183, 188, 227, 240, and 246 on Map II, the detailed logs of which—referenced in the Index—are given on preceding pages in Chapter IX. The 7 following openings and exposures were examined by Gawthrop:

Brown & Goshorn Coal Prospect—No. 542 on Map II.

On east hillside of Upper King Shoals Run, ½ mile northeast of King; **Middle Kittanning Coal**; elevation, 780′ B.

	Ft.	In.
Sandstone, shaly	5	0
Coal, prospect closed, estimated	2	6
Concealed	5	0
Sandstone, massive, visible	50	0

The above opening belongs 55 to 60 feet below another—**No. 485 on Map II**—in the Upper Kittanning Coal bed.

Brown & Goshorn Coal Opening—No. 543 on Map II.

On west hillside of Upper King Shoals Run, 0.9 mile northeast of King; **Middle Kittanning Coal**; coal dips N. 70° W.; elevation, 770′ B.

			Ft.	In.
Shale, bluish-gray, siliceous, visible			10	0
Coal, semi-splint	0′	10″		
Slate, 0″ to	0	1		
Coal, gas, hard (slate floor)	1	6	2	5

At **Coal Prospect No. 544 on Map II,** on Turkey Fork, 2.3 miles southeast of Queen Shoals and ¼ mile east of Kanawha-Clay County Line; elevation, 890′ B.; the **Middle Kittanning Coal** is reported 18 inches in thickness.

At **Coal Exposure No. 545 on Map II,** in bed of Peters Fork, 3.2 miles due south of Queen Shoals; elevation, 965′ B.; 12 inches of **Middle Kittanning Coal** is visible in Peters Fork about 75 feet below the Upper Kittanning bed.

At **Coal Exposure No. 546 on Map II,** on east bank of Falling Rock Creek, ½ mile southeast of Peters Fork; elevation, 980′ B.; the **Middle Kittanning Coal** is exposed, but its thickness not determined by Gawthrop.

Coal Exposure—No. 547 on Map II.

In road on Porter Creek, 1.2 miles southeast of Odessa; **Middle Kittanning Coal**; elevation, 940′ B.

	Ft.	In.
Sandstone, visible	5	0
Concealed	3	0
Coal	0	8
Shale	2	0
Sandstone to run	12	0

The above exposure belongs 80 to 90 feet below the Upper Kittanning bed.

At **Coal Exposure No. 548 on Map II,** on Adonijah Fork, at Crosby, it appears to be the **Middle Kittanning Coal** only 3 inches in thickness that is exposed at an elevation of 1115′ B., at about 100 feet below the Upper Kittanning seam.

Quantity of Middle Kittanning Coal Available.

Based on the evidence given on preceding pages and a determination by Tucker from Map II of the minable area as limited on Figure 9, the following estimate is made for the probable amount of Middle Kittanning Coal available in the area:

Probable Amount of Middle Kittanning Coal.

Counties by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Braxton:					
Birch	1.5	22.20	14,208	928,350,720	37,134,029
Clay:					
Buffalo	1.5	38.00	24,320	1,589,068,800	63,562,752
Henry	3.0	24.55	15,712	2,053,244,160	82,129,766
Pleasant	3.0	31.75	20,320	2,655,417,600	106,216,704
Union	2.0	10.75	6,880	599,385,600	23,975,424
Total for Clay County.		105.05	67,232	6,897,116,160	275,884,646
Total for Both Counties		127.25	81,440	7,825,466,880	313,018,675

In the above table, the thickness assumed for the Middle Kittanning Coal in Henry and Pleasant is only about half that found at many of the prospect openings on Leatherwood and Middle Creeks, but it is believed that the figures given will tend to average up the doubtful regions of each District.

THE NO. 5 BLOCK (LOWER KITTANNING) COAL.

The No. 5 Block (Lower Kittanning) Coal, described briefly in Chapter VII, pages 245-246, from the standpoint of tonnage available and on account of its general excellence, is by far the most valuable bed in the territory of this Report. As shown on Figure 10 below, its approximate minable area is confined to the southeastern portions of each county. Its detailed outcrop is given on Map II. In the northwestern regions of both Braxton and Clay, this coal lies below drainage, but a careful study of the logs of many wells sunk for oil and gas, scattered throughout the localities in question, does not encourage one to expect coal of minable thickness and regularity. By a liberal use of the tables of intervals in Chapter III, pages 26-28, in conjunction with the structure contours on Map II, the approximate elevation of the bed may be determined at any point. It has been opened extensively by natives for local and domestic fuel and the large land-holding companies in each county, and it is this seam that is being operated on a commercial scale at Widen, Clay County. At its type locality—Montgomery, Fayette County, West Virginia—it belongs only 65 to 70 feet above the Kanawha Black Flint, but this interval gradually increases northeastward across the State to the southern part of Lewis County, as shown by the tabular list of localities below:

Table Showing Intervals in Feet Between the No. 5 Block (Lower Kittanning) Coal and the Kanawha Black Flint.

Localities.	Feet.
Montgomery, Fayette County	70
Lizemores, Clay County	85
Head of Middle Creek, southern Clay County	100
Clay-Nicholas Line, southeast of Widen	120
Wolf Creek, Braxton County, Boring No. 38 on Map II	175
Palmer, Braxton County	160
Bablin, 1 mile north of, in Lewis County	170

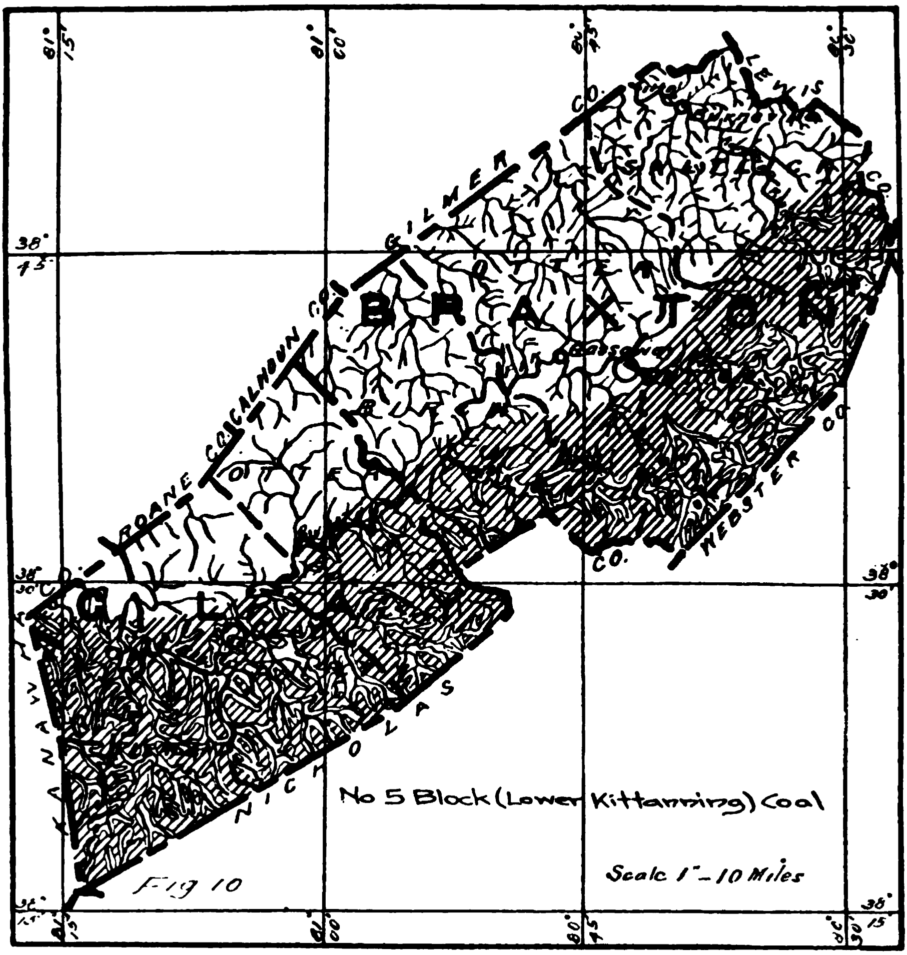

Figure 10.—Map Showing Approximate Minable Area of No. 5 Block (Lower Kittanning) Coal. (See Explanations in Author's Preface).

Its thickness and character at the many country banks. prospect openings, and the single commercial mine will now be described by magisterial districts.

Salt Lick District, Braxton County.

In Salt Lick, the outcrop of the Lower Kittanning (No. 5 Block) Coal is confined to the southeastern portion of the District on the waters of the Little Kanawha River above Falls Mill. Its thickness and stratigraphic position are exhibited in the sections given in Chapter IV for Head of Knawl Creek, Falls Mill, Wildcat — North Edge, Wildcat — 1 Mile Southeast, and Cleveland; in the logs of borings for oil Nos. 48 and 52 on Map II; and Coal Test Boring No. 6 and Salt Water Well No. 11 on same Map. There are no commercial mines on it but the bed has been prospected extensively by natives for local domestic fuel. The seven following openings were examined by the writer:

Floyd Spaur Coal Prospect—No. 549 on Map II.

On west bank of Little Kanawha River, 0.45 mile southeast of Falls Mill; **Lower Kittanning Coal**; elevation, 830' B.

			Ft.	In.
Fire clay, flinty, slightly siliceous, visible			10	0
Shale, sandy, plant fossils abundant			7	0
Coal, slaty	0'	2"		
Sandstone	1	0		
Coal (fire clay floor)	2	0	3	2

The above opening belongs 80 to 90 feet below the crop of the Upper Kittanning bed.

Coal Opening—No. 550 on Map II.

On south bank of Falls Creek, 0.1 mile below mouth of Keith Run; **Lower Kittanning Coal**; elevation, 915' B.

	Ft.	In.
Coal, opening closed, probably 3' 0" to	4	0
Concealed to bed of Falls Creek	10	0

Coal Prospect—No. 551 on Map II.

On south bank of Falls Creek, ⅛ mile above mouth of Right Fork; **Lower Kittanning Coal**; elevation, 960' B.; coal, pinched out by sandstones, only 6 inches thick.

Fred Ware Coal Opening—No. 552 on Map II.

On south bank of Falls Creek, 0.6 mile southeast of mouth of Right Fork; Lower Kittanning Coal; elevation, 995' B.

			Ft.	In.
Sandstone, conglomerate, pebbly, visible			10	0
Coal, soft	0'	7"		
Slate, gray	0	0½		
Coal, soft	0	7		
Shale, gray	1	9		
Coal, semi-splint (slate floor)	1	9	4	8½

J. W. Hardman Coal Opening—No. 553 on Map II.

On south bank of Falls Creek, 0.8 mile southeast of mouth of Right Fork; Lower Kittanning Coal; elevation, 1015' B.

				Ft.	In.
1.	Sandstone, massive, conglomerate, large quartz pebbles, visible			15	0
2.	Coal, soft	0'	6"		
3.	Shale, gray	0	0½		
4.	Coal, soft	0	4		
5.	Shale, gray, coal streaks	2	6		
6.	Coal, semi-splint (slate floor)	4	0	7	4½

No. 6 of above section was concealed by water but thickness is as reported by Mr. G. S. Lowther.

Coal Exposure—No. 554 on Map II.

In edge of road, 0.4 mile S. 25° E. of Duffy, in Lewis County; Lower Kittanning Coal; elevation, 1215' B.; coal blossom, at base of great conglomerate in road.

Coal Opening—No. 555 on Map II.

In a west branch of Pretty Creek, 1.4 miles S. 85° W. of Bablin; Lower Kittanning Coal; elevation, 1140' B.

			Ft.	In.
Coal, bony (shale roof)	2'	0"		
Coal, medium-hard	2	3	4	3
Coal and concealed				

The three following openings in the southeast portion of Salt Lick District were examined by Gawthrop:

Lewis Holden Coal Opening—No. 556 on Map II.

In edge of hill road, west side of Pretty Creek, 0.6 mile southwest of Opening No. 555 above; **Lower Kittanning Coal**; elevation, 1165' B.

			Ft.	In.
Sandstone, visible			5	0
Coal, hard	0'	6"		
Coal, bony	0	3		
Coal, hard	0	9		
Slate, black	0	1		
Coal, good, medium-hard (slate floor)	2	0	3	7

J. P. Bodkin Coal Opening—No. 557 on Map II.

On west hillside of Pretty Creek, ¾ mile N. 50° W. of Wildcat; **Lower Kittanning Coal**; butts, N. 80° W.; faces, N. 10° E.; elevation,

			Ft.	In.
Coal, medium-hard (sandstone roof)	1'	10"		
Sandstone, shaly	2	8		
Coal, medium-hard	0	11		
Slate, black	0	1		
Coal, good, medium-hard	2	1	7	7

Coal Prospect—No. 558 on Map II.

In ravine, 0.3 mile northeast of Wildcat; **Lower Kittanning Coal**; elevation, 1290' B.; opening closed; **coal**, reported about 4' 0" thick.

J. J. Russell Coal Opening—No. 559 on Map II.

In ravine, 1.1 miles S. 5° E. of Wildcat; **Lower Kittanning Coal**; elevation, 1445' B.; examined by the writer; opening closed, **coal** reported 2' 0" thick.

Warwick Malcomb Coal Opening—No. 560 on Map II.

On north hillside of Little Kanawha River, 1.4 miles due west of Wildcat; **Lower Kittanning Coal**; elevation, 1125' B.; examined by Gawthrop.

			Ft.	In.
Sandstone, flaggy, broken			10	0
Sandstone, massive, medium-grained			30	0
Concealed			103	0
Shale			2	0
Coal, roof	1'	0 "		
Coal, medium-hard	0	9		
Shale, dark-gray	0	3½		
Slate, black, hard	0	1½		
Coal	1	3		
Slate, black, 0' 1" to	0	0		
Coal (slate floor)	2	3	5	8

The writer collected a sample for analysis from Nos. 4 and 6 in the following opening:

Taylor Brohard Coal Opening—No. 561 on Map II.

On south bank of Short Run, 2¼ miles due west of Wildcat; Lower Kittanning Coal; elevation, 1080′ B.

				Ft.	In.
1.	Slate roof				
2.	Coal, slaty			0	4
3.	Slate, gray, hard			1	7
4.	Coal, semi-splint, 1′ 4″ to	1′	9″		
5.	Sandstone, slaty, 1″ to	0	3		
6.	Coal, semi-splint	2	2	4	2
7.	Slate and concealed to Short Run			8	0

The analysis of a sample (888H) collected from the above opening, as reported by Messrs. Hite and Krak, is given under No. 561 in the table of coal analyses at the end of this Chapter. The results show a coal of remarkable purity, even excelling the results obtained for the same bed at Widen and southern Clay County at Mines Nos. 677A and 709 on Map II.

William Krafft Coal Opening—No. 562 on Map II.

On west hillside of Laurel Run, 2.4 miles southwest of Wildcat, and 0.65 mile south of Little Kanawha River; butts, N. 85° W.; faces, N. 5° E.; Lower Kittanning Coal; elevation, 1235′ B.; examined by Gawthrop and the writer.

			Ft.	In.
Slate, draw, visible			1	0
Coal, semi-splint	2′	0″		
Sandstone, dark, 0′ 3″ to	0	4		
Coal, semi-splint, 3′ 0″ to	3	2	5	6
Slate floor				

J. P. Bodkin Coal Opening—No. 563 on Map II.

On east hillside of Papaw Run, 1.3 miles northwest of Wildcat; Lower Kittanning Coal; elevation, 1105′ B.; examined by Gawthrop.

			Ft.	In.
Sandstone, massive, brown, coarse, pebbly			20	0
Concealed			50	0
Shale, dark-gray			4	0
Coal, left up	2′	0″		
Shale, dark-gray	0	10		
Sandstone, hard, flinty	0	3		

			Ft.	In.
Coal, medium-hard	1'	4"		
Slate, black	0	1		
Coal, good (shale floor)	2	0	6	6

Willis Townsend Coal Opening—No. 564 on Map II.

On south hillside of Little Kanawha River, 1.3 miles southeast of Falls Mill; **Lower Kittanning Coal?**; elevation, 900' B.; examined by the writer; opening closed; coal, thickness not learned.

Holly District, Braxton County.

In Holly District, the Lower Kittanning (No. 5 Block) Coal attains practically the same development as in Salt Lick, its thickness and position in the measures being shown in the sections given in Chapter IV for Gillespie, Palmer, and Centralia; in the log of the J. B. Marple Well—No. 109C on Map II; and in the log of the Barley Fisher Coal Test Boring—No. 38 on Map II—on Wolf Creek. It has never been mined commercially in Holly but it has been opened extensively by natives for local domestic fuel. The openings described below exhibit its thickness and character over a large portion of the District.

Coal Opening—No. 565 on Map II.

On north hillside of Elk River at Holly Junction railroad station; **Lower Kittanning Coal**; elevation, 1090' B.; examined by the writer; opening closed; coal reported clean and fine and free from sulphur by G. D. Gillespie, with thickness of 2' 4" to 2' 6".

The Lower Kittanning is exhibited at **Opening No. 566 on Map II,** on the north hillside of Elk River, ¾ mile due north of the mouth of Holly—the details of which are published in Chapter IV, pages 97-8, in connection with the Palmer Section.

The 5 following openings on the waters of Elk River in Holly District were examined by the writer:

Coal Opening—No. 567 on Map II.

On point, 0.4 mile northeast of Palmer; **Lower Kittanning Coal**; elevation, 1185′ B.

			Ft.	In.
Sandstone, grayish-white			25	0
Concealed			30	0
Coal, splinty, weathered	1′	0 ″		
Bone	0	1½		
Coal, splinty, weathered	0	10½		
Coal, soft	2	0	4	0
Shale, dark-gray			1	6
Interval to **Kanawha Black Flint**			160	0

John Saulsbury Coal Opening—No. 568 on Map II.

On west side of branch, 1.1 miles N. 25° E. of Palmer; **Lower Kittanning Coal**; butts, N. 80° W.; faces, N. 10° E.; dips to northwest; elevation, 1110′ B.

			Ft.	In.
Sandstone, visible, **East Lynn**			30	0
Coal, medium-hard, slightly bony	1′	3 ″		
Shale, dark-gray	0	1½		
Coal, better	1	0		
Bone, hard	0	2		
Coal, good, softer	1	10	4	4½

The coal from the above mine is hauled to Newville and mouth of Brock Run for domestic fuel.

S. G. Cutlip Coal Opening—No. 569 on Map II.

On south side of Holly River, ½ mile S. 3° W. of Holly; **Lower Kittanning Coal**; elevation, 1350′ B.

				Ft.	In
1.	**Coal, hard, splinty**	2′	0″		
2.	Slate, black, 1″ to	0	3		
3.	**Coal, with thin streaks of slate**	1	0		
4.	**Coal, semi-splint**	3	0		
5.	Slate, black, hard	1	6		
6.	**Coal, medium-soft, extra good**	1	6	9	3
7.	Slate floor				

Nos. 1, 5, and 6 of above section were not exposed, the thickness given being figures furnished by Mr. Cutlip, these having been exposed when the opening was made.

Albert Ware Coal Opening—No. 570 on Map II.

On west side of branch of Kanawha Run, 1.5 miles due north of Holly; **Lower Kittanning Coal**; elevation, 1170' B.; opening closed; posts would indicate 4' 0" to 5' 0" of coal.

W. E. Yeager Coal Opening—No. 571 on Map II.

On east edge of hill road, 1.0 mile N. 10° E. of Holly; **Lower Kittanning Coal**; elevation, 1250' B.

			Ft.	In.
Slate, black, roof				
Coal, slightly slaty, 1' 3" to	1'	6"		
Bone, 3" to	0	5		
Coal, semi-splint, good, 2' 4" to	2	6	4	5
Slate floor				

W. E. Yeager Coal Opening—No. 572 on Map II.

On south side of road, 0.33 mile northeast of Opening No. 571 above; **Lower Kittanning Coal**; elevation, 1315' B.; opening closed; examined by Gawthrop; section as reported by Mr. Yeager.

			Ft.	In.
Coal, medium-soft (shale roof)	1'	6"		
Slate or bone	0	4		
Coal, harder (slate floor)	2	5	4	3

Ira V. Bright Coal Opening—No. 573 on Map II.

On south hillside, ¼ mile southeast of mouth of Long Fork of Laurelpatch; **Lower Kittanning Coal**; elevation, 1415' B.; examined by the writer.

			Ft.	In.
Shale, dark, visible			3	0
Coal, medium-hard	0'	5"		
Shale, dark-gray	0	9		
Coal, good	0	10		
Shale, bluish-gray, medium-hard	0	4		
Coal, slightly bony	0	10		
Coal, bony	1	7		
Coal, medium-soft, good (slate floor)	2	7	7	4

H. H. Cutlip Coal Opening—No. 574 on Map II.

On east hillside of Long Fork, 1.4 miles N. 10° W. of Marpleton; **Lower Kittanning Coal**; elevation, 1415' B.

			Ft.	In.
Coal, slaty (shale roof)	0'	4"		
Slate	0	3		

			Ft.	In.
Coal, medium-hard	0'	4"		
Slate	0	5		
Coal, good	2	3		
Shale and slate	1	6		
Coal, partly concealed by water	1	1	6	2
Shale and concealed				

"The upper 1' 4" of the above section is left up, the lower 4' 10" only being taken down in mining operations. Could not get to face of bank on account of water."

N. M. Kniceley Coal Opening—No. 575 on Map II.

On west hillside of Long Fork, 1.9 miles N. 15° W. of Marpleton; Lower Kittanning Coal; elevation, 1405' B.

			Ft.	In.
Coal	4'	0"		
Slate, 2' 0" to	1	0		
Coal	1	2	6	2

Jennie Kniceley Coal Opening—No. 576 on Map II.

On branch of Long Fork, 2.0 miles N. 8° W. of Marpleton; Lower Kittanning Coal; butts, N. 85° W.; faces, N. 5° E.; elevation, 1370' B.

				Ft.	In.
1.	Coal, slaty (dark shale roof)	0'	3"		
2.	Coal	1	6		
3.	Shale, gray, dark	1	6		
4.	Coal, medium-hard	0	6		
5.	Slate, dark	0	5		
6.	Coal, medium-hard (shale floor)	2	0	6	2

The analysis of a sample (162G) collected by Gawthrop from Nos. 4 and 6 of above section, the only ones mined here, as reported by Messrs. Hite and Krak, is given under **No. 576** in the table of coal analyses at the end of this Chapter.

The five following openings on Wolf Creek in the southwest portion of Holly District were examined by Gawthrop and have been correlated with the Lower Kittanning, but may possibly represent the Middle Kittanning, since the latter is separated from the Lower Kittanning by an interval of only 2½ feet at Palmer. The bed at the openings in question is so low down near the drainage that the succession below them could not be determined by Gawthrop.

Robinson Co. Coal Opening—No. 577 on Map II.

On east bank of Wolf Creek, ⅛ mile northwest of Bee Hollow; **Lower Kittanning Coal**; elevation, 880′ B.

			Ft.	In.
Sandstone, flaggy, visible			2	0
Shale, siliceous			2	0
Fire clay, black			0	6
Coal, weathered	0′	10″		
Sandstone	1	6		
Shale, dark, slaty	1	6		
Coal	0	4		
Slate	0	2		
Coal, medium-hard	1	7	5	11
Shale and concealed to Wolf Creek			5	0

Coal Opening—No. 578 on Map II.

On east bank of Wolf Creek, 0.2 mile south of Bee Hollow; **Lower Kittanning Coal**; elevation, 905′ B.

			Ft.	In.
Coal, slaty (slate roof)	0′	6″		
Slate	0	4		
Coal, hard, blocky	0	4		
Sandstone, shaly	7	0		
Slate, coaly	0	8		
Coal	1	4	10	2
Sandstone to road			6	0

David Barnett Coal Opening—No. 579 on Map II.

On west bank of Wolf Creek, at mouth of Left Fork; **Lower Kittanning Coal**; elevation, 960′ L.

			Ft.	In.
Sandstone, shaly, visible			8	0
Shale, dark			3	0
Slate, coaly			1	0
Coal	0′	4″		
Fire clay shale	0	2		
Coal, hard	2	0	2	6
Shale and flaggy sandstone			5	0
Sandstone, massive and flaggy, to Wolf Creek			5	0

Coal Opening—No. 580 on Map II.

On east bank of Wolf Creek, 0.2 mile south of mouth of Left Fork; **Lower Kittanning Coal**; elevation, 975′ B.

	Ft.	In.
Shale, dark, slaty	5	0
Fire clay, dark	1	6

			Ft.	In.
Slate, coaly	1'	0"		
Coal	0	7		
Slate	0	1		
Coal, medium-hard	0	3		
Coal, splinty	0	9		
Coal, hard	0	10	3	6
Slate and concealed to run			5	0

Ellis James Coal Opening—No. 581 on Map II.

On east bank of Wolf Creek, 1.6 miles due north of Ramp Run P. O.; Lower Kittanning Coal; elevation, 1190' B.

			Ft.	In.
Sandstone, massive, brown, visible			2	0
Coal, 0' 2" to	0'	5"		
Slate, 0' 5" to	0	1		
Coal, hard	0	7		
Coal, gray splint	0	5		
Coal, hard	0	11		
Coal, gray splint	0	5		
Coal, softer (shale floor)	0	4	3	2

Coal Prospect—No. 582 on Map II

On east bank of branch of Wolf Creek, 0.33 mile S. 85° E. of Opening No. 581 above; Lower Kittanning Coal; elevation, 1225' B.; examined by Gawthrop and the writer.

			Ft.	In.
Sandstone, massive, visible			20	0
Shale, with coal streaks			1	0
Shale, concealed, and sandstone			8	0
Shale			1	0
Coal, medium-hard	1'	6"		
Coal, hard, splinty	0	7		
Sandstone, shaly	1	6		
Coal	0	7		
Slate, coaly	0	9		
Coal, medium-soft	0	8		
Coal, harder (shale floor)	2	0	7	7

The three following openings on Wolf Creek waters were examined by Gawthrop:

R. M. Gross Coal Opening—No. 583 on Map II.

In ravine on west side of Left Fork of Wolf Creek, ½ mile south of mouth of Spruce Fork; **Lower Kittanning Coal**; elevation, 1200′ B.

			Ft.	In.
Coal (shale roof)			0	4
Shale, brownish-gray, siliceous			6	0
Coal, soft, gas	3′	0″		
Slate, gray, 0′ 6″ to	0	4		
Coal, soft, gas	1	0	4	4

Coal Prospect—No. 584 on Map II.

In ravine on west side of Left Fork of Wolf Creek, opposite mouth of Spruce Fork; **Lower Kittanning Coal**; elevation, 1165′ B.

			Ft.	In.
Sandstone, shaly, slaty, visible			5	0
Coal, cannelly, slaty	1′	2″		
Coal, hard, semi-splint	1	1		
Slate	0	2		
Coal, hard (shale floor)	0	9	3	2

Albert Sutton Coal Opening—No. 585 on Map II.

On south bank, 0.6 mile due east of mouth of Spruce Fork; **Lower Kittanning Coal**; elevation, 1185′ B.

			Ft.	In.
Sandstone, coarse, grayish-brown, current-bedded, visible			12	0
Black slate, traces of **coal**			0	8
Coal, semi-splint	2′	1″		
Shale, gray, with streak of **coal**	0	5		
Coal, hard (slate floor)	0	6	3	0

The 6 following openings were examined by the writer:

Coal Opening—No. 586 on Map II.

On south bank of Elk River, just east of mouth of Stony Creek; **Lower Kittanning Coal**; elevation, 860′ B.; opening closed; thickness not learned.

Robinson Coal Opening—No. 587 on Map II.

On east bank of Stony Creek, 1.6 miles S. 35° W. of Gillespie; **Lower Kittanning Coal**; elevation, 1010' B.

			Ft.	In.
Sandstone, **East Lynn**, current-bedded, visible...			20	0
Coal, bony, and slate, interlaminated	1'	4"		
Coal, bony	0	7		
Shale, gray	0	7		
Coal	0	2		
Shale, gray, dark	0	6		
Shale, sandy, hard	1	0		
Coal, semi-splint (only portion mined) (to slate floor)	2	1	6	3

Coal Exposure—No. 588 on Map II.

In north edge of hill road, 1.1 miles west of Bakers Run railroad station; **Lower Kittanning Coal**; elevation, 1215' B.; **coal blossom**, heavy, in road.

Brockerhoff Heirs Coal Opening—No. 589 on Map II.

On north side of road at crossing of Mill Creek, 1.1 miles west of Centralia; surface owned by West Branch Lumber Co.; minerals, by Brockerhoffs; **Lower Kittanning Coal**; elevation, 1435' L.; opening closed; **coal reported** by Mr. W. T. Diggins of Centralia 2' 0" thick.

L. R. Knight Coal Opening—No. 590 on Map II.

On south bank of Lick Creek, 2.4 miles S. 50° W. of Centralia; **Lower Kittanning Coal**; elevation, 1415' B.

	Ft.	In.
Sandstone, grayish-white, medium-grained, visible	15	0
Coal, medium-hard (slate floor)	1	10

Ross F. Stout (Neal Bros.) Coal Opening—No. 591 on Map II.

In Webster County, head of branch of Laurel Creek, 2.4 miles N. 5° E. of Erbacon; **Lower Kittanning Coal**; elevation, 1725' B.

			Ft.	In.
Coal, visible	0'	4"		
Shale, gray	0	7		
Coal	0	7		
Shale, gray	0	5		
Coal, medium-soft	1	6		
Shale, black	0	4		
Coal, soft	0	3		
Coal, splinty, hard	0	11		
Coal, softer	2	0		
Shale, gray	0	4		
Coal, medium-hard (gray slate floor)	0	7	7	10

The 15 following openings on the waters of Little Birch River in the southern portion of Holly District were examined by Gawthrop:

David Jackson Coal Opening—No. 592 on Map II.

On east bank of Twolick Run, 0.4 mile north of Little Birch P. O.; **Lower Kittanning Coal**; elevation, 1150′ B.; coal, semi-splint (shale roof and floor), 2′ 10″ thick.

David Jackson Coal Opening—No. 593 on Map II.

On north bank of Twolick Run, just north of Little Birch P. O.; **Lower Kittanning Coal**; elevation, 1165′ B.

			Ft.	In.
Sandstone, massive, brown			30	0
Concealed and shale			40	0
Coal, slaty, visible			0	3
Shale, brown, siliceous			5	0
Shale, dark-gray			1	6
Coal, medium-hard	0′	6″		
Coal, semi-splint	1	6		
Coal, gas	0	7		
Coal, splint	0	4		
Coal, gas	0	10	3	9

Coal Opening—No. 594 on Map II.

In run, 0.3 mile east of Little Birch P. O.; **Lower Kittanning Coal**; elevation, 1230′ B.

			Ft.	In.
Coal, gas, hard (shale roof)	1′	0″		
Coal, splint	0	6		
Coal, gas, hard	0	6		
Coal, splint	1	0		
Coal, softer (shale floor)	0	5	3	5

The details of the **D. L. Evans Coal Opening—No. 595 on Map II**—in ravine on west side of Carpenter Fork, 1.3 miles southeast of Little Birch P. O.; **Lower Kittanning Coal**; elevation, 1390′ B.; are given in Chapter IV in the Section for Little Birch P. O.—1.3 Miles Southeast, page 106.

Van Facemire Coal Opening—No. 596 on Map II.

On west hillside of Carpenter Fork, 3.0 miles S. 10° E. of Little Birch P. O.; **Lower Kittanning Coal**; elevation, 1705′ B.

			Ft.	In
Coal, gas (fire clay shale roof)	0′	8″		
Shale, dark, siliceous	2	6		
Coal, semi-splint	1	0		
Coal, splint	2	0		
Coal, semi-splint (shale floor)	0	8	6	10

Pamley Messenger Coal Opening—No. 597 on Map II.

On north bank of branch of Carpenter Fork, 0.9 mile N. 45° E. of Opening No. 596; **Lower Kittanning Coal**; elevation, 1675′ B.

			Ft.	In.
Sandstone, shaly, visible			5	0
Shale, dark-gray			5	0
Coal, semi-splint	1′	6″		
Coal, splint	1	6		
Coal, semi-splint (shale floor)	0	8	3	8

W. S. Hines Coal Opening—No. 598 on Map II.

On north hillside of Little Birch River, 0.3 mile southeast of Little Birch P. O.; butts, N. 80° W.; faces, N. 10° E.; **Lower Kittanning Coal**; elevation, 1270′ B.

			Ft.	In.
Sandstone, Lower Kittanning, massive, gray, medium-grained			35	0
Concealed, with sandstone			30	0
Sandstone, massive, brownish-gray, pebbly at top			25	0
Concealed, with shale at base			31	0
Coal, soft	0′	6″		
Coal, semi-splint	1	6		
Coal, gas	0	6		
Coal, semi-splint	0	6		
Coal, gas (shale floor)	0	6	3	6

Coal Prospect—No. 599 on Map II.

On east hillside of Fisher Run, 1.0 mile N. 87° W. of Ramp Run P. O.; **Lower Kittanning Coal**; elevation, 1335′ B.; opening closed; coal, soft, reported 2′ 6″ thick.

Robert Sartin Coal Opening—No. 600 on Map II.

On east hillside of Ramp Run, 1.5 miles south of Ramp Run P. O.; **Lower Kittanning Coal**; elevation, 1690' B.

			Ft.	In.
Coal, slaty (shale roof)	0'	6"		
Coal, gas, hard	1	2		
Coal, bony	0	6		
Coal, semi-splint	1	8		
Coal, gas, hard	0	10		
Shale, gray	0	3		
Coal, gas	0	7		
Coal, splint	1	6	7	0
Shale and concealed			5	0
Sandstone, massive			10	0

Samuel Harris Heirs Coal Opening—No. 601 on Map II.

On branch of Little Birch River, 0.8 mile N. 20° E. of Ramp Run P. O.; **Lower Kittanning Coal**; elevation, 1325' B.

			Ft.	In.
Shale, brownish-gray, siliceous, visible			12	0
Slate, coaly	0'	10"		
Coal, weathered, near crop	1	4		
Coal, medium-soft, gas	2	0		
Slate, dark-gray	0	3		
Coal, gas	0	6		
Shale, dark-gray	0	5		
Coal, splinty (shale floor)	1	6	6	10

The above, according to Gawthrop, belongs 50 to 60 feet below the Middle Kittanning bed and about 125 feet below the Upper Kittanning seam.

W. I. Tinney Coal Opening—No. 602 on Map II.

On south hillside of Little Birch River, 0.4 mile N. 65° E. of Ramp Run P. O.; **Lower Kittanning Coal**; elevation, 1450' B.

			Ft.	In.
Coal, semi-splint (shale roof)	1'	10"		
Coal, medium-hard, gas	2	0		
Shale, gray	0	6		
Coal, gas	0	9		
Shale, gray	0	5		
Coal, gas	0	3		
Shale, gray	0	1		
Coal, splint (shale floor)	1	5	7	3

Charles Whytsell Coal Opening—No. 603 on Map II.

On east hillside of Little Birch River, 0.9 mile S. 80° E. of Ramp Run P. O.; Lower Kittanning Coal; elevation, 1495' B.

			Ft.	In.
Sandstone, massive, broken, visible			10	0
Coal, semi-splint	2'	0"		
Shale, gray	0	8		
Coal, visible	1	0		
Coal, concealed, reported (shale floor)	0	10	4	6

James Whytsell Coal Opening—No. 604 on Map II.

On south hillside of Little Birch River, 0.3 mile southwest of mouth of Right Fork; Lower Kittanning Coal; elevation, 1565' B.

			Ft.	In.
Sandstone, massive, broken, visible			5	0
Coal, semi-splint	1'	6"		
Shale, 0' 2" to	0	0		
Coal, gas	0	6		
Shale, dark-gray	0	11		
Coal, medium-hard	0	8		
Coal, splinty (shale floor)	1	0	4	7

Coal Opening—No. 734 on Map II.

On east bank, ½ mile up Bluelick Run, 2½ miles S. 55° E. of Ramp Run P. O.; No. 5 Block (Lower Kittanning) Coal; elevation, 1555' B.

			Ft.	In.
Shale, brown, siliceous, with sandstone streaks, visible			8	0
Coal, soft	1'	0"		
Coal, semi-splint	1	6		
Coal, soft	2	7	5	1
Slate			2	0
Sandstone, visible			5	0
Concealed			8	0
Coal, Clarion—Little No. 5 Block, reported 18" to			2	0

The three following openings, just across the line from Holly District in the edge of Nicholas County, were examined by the writer:

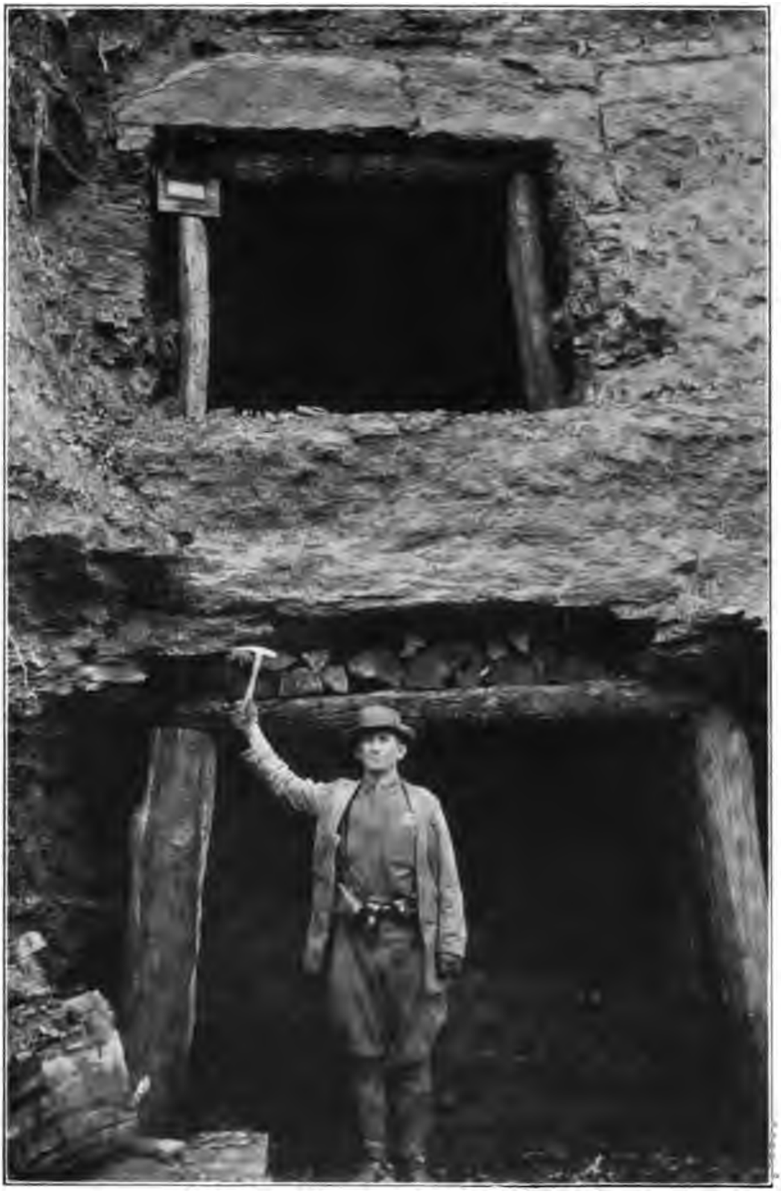

Photo by McClellan Leonard.

PLATE XXIV.—Showing close proximity of Stockton and Coalburg Coals at Openings Nos. 788 and 878 on Map II. (See pages 703-4.) Kanawha Black Flint forms roof of upper opening.

Coal Opening—No. 605 on Map II.

On north hillside of a branch of Skyles Creek, ½ mile southwest of Waggy; **Lower Kittanning Coal**; elevation, 1825' B.

			Ft.	In.
Sandstone, medium-grained, makes great cliff, **East Lynn**			40	0
Shale, dark bluish-gray, plant fossils abundant			2	9
Sandstone, dark, plant fossils, no marine fossils			0	3
Coal, semi-splint	1'	5"		
Slate, black, bony	0	1½		
Coal, semi-splint (slate floor)	2	2½	3	9

James Long Coal Opening—No. 606 on Map II.

On east hillside of Mill Creek, 3½ miles west of Waggy; **Lower Kittanning Coal**; elevation, 1590' B.

			Ft.	In.
Coal (shale roof)	0'	3"		
Shale, dark, sandy, 1' 3" to	1	6		
Coal, semi-splint	1	1		
Bone, slaty	0	2		
Coal, semi-splint	2	5	5	5

Coal Exposure—No. 607 on Map II.

In road, 0.3 mile southwest of mouth of Brier Run of Mill Creek; **Lower Kittanning Coal**; elevation, 1600' B.; **coal blossom**, heavy, in road, 3' 0" to 4' 0" thick, 10 feet above cliff.

Otter District, Braxton County.

In Otter District, the thickness and position in the measures of the No. 5 Block (Lower Kittanning) Coal are exhibited in the sections given in Chapter IV for Gravel Fork of Laurel, page 74, and in the logs of wells Nos. 74 and 76 on Map II, sunk for oil and gas. Its outcrop is confined to the southern portion of the District on the waters of Little Birch River, the two following openings, examined by the writer. being the only exposures observed:

John Pierson Coal Opening—No. 608 on Map II.

On east side of hill road, head of Laurel Run, 2½ miles S. 10° W. of Little Birch P. O.; **Lower Kittanning Coal**; elevation, 1480' B.; opening closed; sufficient coal once mined from this bank to dry lumber for Pierson residence; reported 2 to 3 feet thick.

For details of the **George Keener Coal Opening—No. 609 on Map II**—on west hillside of Laurel Run, at mouth of Gravel Fork; **Lower Kittanning Coal**; elevation, 1405′ B.; see Section for Gravel Fork of Laurel Creek, in Chapter IV, page 74.

Birch District, Braxton County.

In Birch District, the No. 5 Block (Lower Kittanning) Coal attains fair development in that portion southeast of Elk River as shown on Figure 10, its thickness and stratigraphic position being exhibited in the sections given in Chapter IV for Sleith—1.7 Miles Northeast, Twistville-Diatter Run, Herold—Northeast, Herold—South, Glendon, Jennings—0.4 Mile Southeast, and Jennings—2 Miles Southeast; and in the logs of wells Nos. 78, 79, 86, 87, 100, and 108 on Map II. On the waters of Birch River and Strange Creek, it has been prospected quite extensively by natives for local domestic fuel, but never mined on a commercial scale. The three following openings on Birch were examined by Gawthrop:

L. N. Johnson Coal Prospect—No. 610 on Map II.

On south hillside of Birch River at Herold; **No. 5 Block (Lower Kittanning) Coal**; elevation, 950′ B.

	Ft.	In.
Sandstone, massive, medium-grained, brownish-gray, pebbly, forms great cliff, **East Lynn**, visible	30	0
Coal, concealed, reported	1	6

Coal Opening—No. 611 on Map II.

On north hillside of Birch River, at Herold; **No. 5 Block (Lower Kittanning) Coal**; elevation, 940′ B.

	Ft.	In.
Sandstone, massive, gray, hard, flinty, medium-grained, micaceous, **East Lynn**	55	0
Coal	1	0
Shale, siliceous	1	0
Sandstone, **Homewood**, massive, hard, gray, micaceous, to river, at Herold	25	0

The East Lynn Sandstone has almost cut out the coal at the above opening.

L. N. Johnson Coal Opening—No. 612 on Map II.

At run fork, 0.4 mile southwest of Herold; **No. 5 Block (Lower Kittanning) Coal**; butts, N. 80° W.; faces, N. 10° E.; elevation, 970′ B.

			Ft.	In.
Sandstone, massive, hard, gray, visible			6	0
Coal, gas, medium-hard	1′	10″		
Shale, gray	0	5		
Coal, gas	0	8		
Coal, splint	0	6		
Coal, gas (slate floor)	0	7	4	0

The 6 following openings in Birch District, northwestward from Herold along Birch River, were examined by the writer:

George Herold Coal Opening—No. 613 on Map II.

On east bank of Birch River, 0.33 mile northwest of Herold; **No. 5 Block (Lower Kittanning) Coal**; elevation, 925′ B.

			Ft.	In.
Sandstone, grayish-white, visible			15	0
Coal, reported	2′	6″		
Shale, dark bluish-gray	8	0		
Coal, reported	2	6	13	0

C. C. Ballenger Coal Opening—No. 614 on Map II.

On south bank of Birch River, 0.65 mile northwest of Herold; **No. 5 Block (Lower Kittanning) Coal**; elevation, 885′ B.

			Ft.	In.
Sandstone, **East Lynn**, grayish-white, massive to current-bedded, makes great cliff, small pebbles, 25′ 0″ to			35	0
Shale, dark, 0″ to			0	6
Coal, gas, medium-hard	0′	9″		
Bone, 0″ to	0	1		
Coal, gas, medium-hard	1	4		
Shale, gray, soft	0	10		
Coal, gas, medium-hard	0	8		
Bone, 4″ to	0	6		
Coal, medium-hard	0	10		
Coal, slaty (shale floor)	0	1	5	1

George Herold Coal Opening—No. 615 on Map II.

On north bank of Birch River, 0.9 mile northwest of Herold; **No. 5 Block (Lower Kittanning) Coal**; elevation, 870′ B.; opening at base of grayish-white sandstone cliff, thickness not learned.

H. E. Shaver Heirs Coal Opening—No. 616 on Map II.

On north bank of Birch River, 1.3 miles northwest of Herold; **No. 5 Block (Lower Kittanning) Coal**; elevation, 865′ B.

			Ft.	In.
Shale, dark and brown, sandy, plant fossils, but a long search revealed no marine fauna			6	0
Coal, slaty	0′	2″		
Shale, fire clay	0	10		
Coal, semi-splint	2	3		
Slate, dark-gray, 3″ to	0	4		
Coal, splinty	1	9		
Coal, splinty, bony	0	4		
Coal, semi-splint (gray shale floor)	0	11	6	7

William Hamric Coal Opening—No. 617 on Map II.

On north bank, ⅛ mile up Middle Creek from Birch River; **No. 5 Block (Lower Kittanning) Coal**; elevation, 850′ B.; section by Gawthrop.

			Ft.	In.
Sandstone, massive, visible			10	0
Shale, dark			8	0
Coal, gas, hard	2′	0″		
Shale, gray	0	4		
Coal, splinty (shale floor)	1	4	3	8

Benton Givean Coal Opening—No. 618 on Map II.

On south bank of Birch River, 0.6 mile due south of mouth of Diatter Run; **Lower Kittanning Coal**; elevation, 820′ B.

	Ft.	In.
Grayish-white sandstone, 30′ 0″ to	35	0
Coal, opening closed; 5 to 6′ above water in Birch River; thickness of coal not learned.		

Coal Prospect—No. 619 on Map II.

On south bank of Strange Creek, 0.4 mile east of Jennings; **Lower Kittanning Coal**; elevation, 905′ B.; see Section for 0.4 Mile Southeast of Jennings, in Chapter IV, page 90; examined by Gawthrop; elevation, 905′ B.

			Ft.	In.
Slate and **coal**, visible	2′	0″		
Shale, gray, hard	1	0		
Coal	1	0	4	0
Concealed to creek			6	0

C. W. (John) Taylor Heirs Coal Opening—No. 620 on Map II.

On east hillside of Strange Creek, 0.6 mile southeast of Jennings; Lower Kittanning Coal; elevation, 960' B.; section by Gawthrop.

				Ft.	In.
1.	Sandstone, broken, visible			5	0
2.	Coal, gas, slaty	1'	0"		
3.	Coal, gas	0	6		
4.	Cannel slate	0	10		
5.	Coal, gas	0	7		
6.	Shale, gray	1	0		
7.	Coal, gas	0	7		
8.	Cannel slate	0	8		
9.	Coal, splint (shale floor)	1	4	6	6

The analysis of a sample (167G) collected by Gawthrop from Nos. 3, 5, 7, and 9 of above section, as reported by Messrs. Hite and Krak, is given under **No. 620** in the table of coal analyses at the end of this Chapter.

The writer also measured a section at a different point in the above mine, as follows:

			Ft.	In.
Coal, bony (sandstone roof)	0'	9"		
Coal, gas	0	6		
Coal, splint	0	4		
Bone	0	3		
Coal, gas, medium-soft	0	9		
Slate, gray, soft	0	10		
Coal, gas, medium-hard	0	8		
Bone	0	6		
Coal, splint, hard	1	6		
Slate, gray	0	6		
Coal, semi-splint (slate floor)	0	9	7	4

William Perkins Coal Opening—No. 621 on Map II.

On east hillside of Strange Creek, 300 feet northwest of Braxton-Nicholas County Line; Lower Kittanning Coal; elevation, 1120' B.; examined by Gawthrop.

			Ft.	In.
Coal, weathered (shale roof)	1'	6"		
Cannel slate or bone	0	9		
Coal	1	3		
Coal, splint	0	8		
Coal, gas	0	5		
Shale, gray	0	5		
Coal, gas	0	6		
Coal, hard, splinty (shale floor)	2	6	8	0

Gawthrop reports that the top part of the bottom member of the coal section above is probably cannel slate; that he could not get back far enough to get good detailed section.

The three following openings, located on the waters of Strange Creek, in Nicholas County, were examined by the writer:

Dille Coal Opening—No. 622 on Map II.

On south bank, 0.6 mile up Brushy Fork of Strange Creek; **Lower Kittanning Coal**; elevation, 1155′ B.

			Ft.	In.
Sandstone, grayish-white, roof				
Coal and slate mixed	2′	0″		
Slate, gray	0	10		
Coal, splinty (slate floor)	2	0	4	10

Samuel Murphy Coal Opening—No. 623 on Map II.

On south bank, ⅛ mile up Trace Fork of Strange Creek; **Lower Kittanning Coal**; elevation, 1175′ B.

			Ft.	In.
Sandstone, grayish-white, makes cliff, visible			20	0
Slate, sandy			4	0
Coal	0′	4″		
Bone, hard	0	5		
Coal, semi-splint	1	4		
Slate, sandy	0	5		
Coal, splint	0	6	3	0
Slate and concealed to branch			7	0

Cora Brown Coal Opening—No. 624 on Map II.

On west hillside of Birch River, 2.7 miles south of mouth of Little Birch River; **Lower Kittanning Coal**; elevation, 1245′ B.

			Ft.	In.
Sandstone, visible			5	0
Shale, dark, sandy, plant fossils abundant			1	3
Coal	0′	1½″		
Slate, medium-hard, dark	0	4		
Coal, gas, medium-hard	2	1		
Slate, dark-gray	0	10		
Coal, gas, hard (slate floor)	0	6	3	10½

Otter District, Clay County.

In Otter District, the thickness and stratigraphic position of the No. 5 Block (Lower Kittanning) Coal are exhibited in the sections given in Chapter IV for Big Otter, Mouth ot O'Brien—**Coal Opening No. 625 on Map II,** on east bank, 0.1 mile up O'Brien Creek—Groves—0.6 Mile Southwest, Ivydale; and in the logs of wells Nos. 111 and 112. Its outcrop is confined to the southeastern border of the District along Elk River below the mouth of Frame Run, where it has been prospected to some extent between the two great sandstone cliffs—Upper East Lynn and East Lynn—at 140 to 160 feet below the Upper Kittanning Coal. The four following openings examined by Gawthrop are fairly representative in this region:

Coal Opening—No. 626 on Map II.

On west hillside of Elk River, 0.4 mile south of Groves; No. 5 Block (Lower Kittanning) Coal; elevation, 835' B.; opening closed, coal reported 4 feet thick.

J. M. Boggs Coal Opening—No. 627 on Map II.

On north hillside of Elk River, opposite mouth of Jumping Gut; No. 5 Block (Lower Kittanning) Coal; elevation, 830' B.

			Ft.	In.
Sandstone, partly concealed, East Lynn			50	0
Sandstone, massive, gray, hard, East Lynn			10	0
Coal	0'	3"		
Shale, gray	0	4		
Coal	0	2		
Slate, coaly	2	0		
Coal	0	5		
Shale	0	2		
Coal, hard, splinty	2	2	5	6
Shale and concealed			2	0
Sandstone			25	0

Coal Prospect—No. 628 on Map II.

On west hillside of Elk River, 0.9 mile north of Jessica; No. 5 Block (Lower Kittanning) Coal; elevation, 855' B.

	Ft.	In.
Sandstone, massive, visible	5	0
Coal, concealed	...	..
Concealed, with shale	5	0
Sandstone, Homewood, massive, pebbly, coarse, gray or brownish-gray	85	0

Coal Prospect—No. 629 on Map II.

On north hillside of Elk River, 1.2 miles east of Ivydale; No. 5 Block (Lower Kittanning) Coal; elevation, 845' B.

			Ft.	In.
Sandstone, massive, visible			5	0
Shale			3	0
Coal	0'	3"		
Shale	2	0		
Coal, slaty	0	6		
Coal, slaty	1	0	3	9
Shale, gray			1	0
Concealed			5	0
Sandstone, Homewood, massive, gray			20	0

J. M. Boggs et al. Coal Opening—No. 630 on Map II.

On north hillside of Laurel Run, 0.4 mile due north of Ivydale; No. 5 Block (Lower Kittanning) Coal; elevation, 875' B.

			Ft.	In.
Sandstone, coarse, brown, visible			6	0
Shale, gray			2	0
Slate, black, coal streaks			0	6
Shale, gray			0	10
Coal, slaty	0'	3"		
Slate, black	0	7		
Shale, gray	0	8		
Shale, dark, coal streaks	0	9		
Coal, bony	0	3		
Shale, gray	0	4		
Coal, bony	0	6		
Coal, good	2	0	5	4
Concealed by water				

Buffalo District, Clay County.

In Buffalo District, the thickness and stratigraphic position of the No. 5 Block (Lower Kittanning) Coal are exhibited in the sections given in Chapter IV for Groves—1 Mile Southwest—**Coal Opening No. 632 on Map II,** on south hillside of Elk River—Widen—North Edge, Widen—3 Miles Northeast, Eakle—¾ Mile Southeast, and Cressmont. In the northern portion of the District, its outcrop is confined to Elk River below Frame Run and the immediate valley walls of the tributaries of the former stream, and in the southern, to the waters of Buffalo and Strange Creeks. It has been prospected extensively by the natives for local domestic fuel and by the large land-holding companies. The only commercial mine on it in either county is located at Widen on Buffalo Creek. The two following exposures were examined by the writer along the northern boundary:

Coal Exposure—No. 631 on Map II.

In Coal and Coke Railway bridge abutment foundation pit, Frame Run, 1.6 miles south of Villa Nova; No. 5 Block (Lower Kittanning) Coal; elevation, 775′ B.

	Ft.	In.
Sandstone, East Lynn	40	0
Coal, clean, reported by D. M. Duffield in making the excavations for the abutments of the Coal and Coke Railway bridge over Frame Run	4	0

James and Levi Reed Coal Opening—No. 633 on Map II.

On east bank of Jumping Gut, ¼ mile up from Elk River; No. 5 Block (Lower Kittanning) Coal; elevation, 840′ B.

			Ft.	In.
Sandstone, grayish-white, visible			6	0
Shale, buff, 0″ to			0	6
Coal, semi-splint	0′	4″		
Shale, dark, argillaceous	0	6		
Coal, splint, bony	0	3		
Coal and slate mixed	1	6		
Coal, gray splint	0	5		
Slate, gray	0	6		
Coal, gray splint, hard (slate floor)	2	3	5	9

The eight following openings, in Buffalo District and the edge of Nicholas County on the waters of Buffalo and Strange Creeks, were examined by the writer:

Coal Opening—No. 634 on Map II.

In ravine, north side of Rockcamp Run, 2¾ miles northwest of Widen; No. 5 Block (Lower Kittanning) Coal; elevation, 1180′ B.

			Ft.	In.
Coal, semi-splint (sandstone roof)	0′	11″		
Shale, black	0	6		
Coal, slaty	0	1		
Coal, semi-splint	1	5		
Shale, black	0	5		
Coal, splint	1	10		
Bone, hard, splinty	0	5		
Coal, splint, hard (slate floor)	2	7	8	2

Coal Opening—No. 635 on Map II.

On north bank of Rockcamp Run, 2.1 miles northwest of Widen; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1278' L.

			Ft.	In.
Coal, visible	0'	11"		
Shale, black	0	6		
Coal, semi-splint to gas, medium-hard	1	6		
Bone	0	4		
Coal, gray splint, hard	1	6		
Coal, gas, medium-soft	0	3		
Coal, gray splint, hard	0	3		
Coal, concealed by water	1	4	6	7

The above opening is 20 feet above the casing head of the **Elk River Coal and Lumber Company Well—No. 114 on Map II**, the detailed log of which is published in Chapter IX, pages 353-354.

S. T. Wilson et al. Coal Opening—No. 636 on Map II.

On north bank of Dille Run, 0.6 mile west of Dille P. O.; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1248' L.

			Ft.	In.
Coal, roof				
Coal, bony	0'	8"		
Coal, gas, medium-hard	0	11		
Slate, black	0	6		
Coal, gas, harder	0	7		
Slate, black, bony, 4" to	0	5		
Coal, gray splint, hard	1	8		
Coal, gas, medium-soft	0	5		
Coal, gray splint, hard	2	2		
Slate, reported	0	5		
Coal, semi-splint (slate floor)	1	6	9	3

Henry Butcher Coal Opening—No. 637 on Map II.

On west hillside of Strange Creek, just northwest of mouth of Dille Run; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1270' B.; opening closed, thickness not learned.

Coal Opening—No. 638 on Map II.

On north bank of Lick Run, 0.7 mile northeast of Dille P. O.; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1235' B.; opening closed, thickness not learned.

Andy Brown Coal Opening—No. 639 on Map II.

On east bank of Strange Creek, 0.2 mile southeast of mouth of Dille Run; No. 5 Block (Lower Kittanning) Coal; elevation, 1275′ B.

			Ft.	In.
Sandstone, yellowish-brown				
Coal, gas, medium-hard	0′	6″		
Coal, bony	0	10		
Coal, gas, medium-soft	1	2		
Shale, gray, dark	0	7		
Coal, gas, hard	0	6		
Shale, gray, soft, ½″ to	0	1		
Coal, slightly bony	0	4		
Coal, gray splint	1	2		
Coal, gas, medium-soft	0	2		
Coal, gray splint	1	3		
Coal, gas, medium-soft (sandstone floor)	0	2	6	9

Preston Hickman Coal Opening—No. 640 on Map II.

On west bank, 0.1 mile up Road Fork of Strange Creek; No. 5 Block (Lower Kittanning) Coal; elevation, 1360′ B.; in Widen—3 Miles Northeast Section, page 115; opening not closed, but dangerous, about 6 feet of coal with partings visible.

Coal Opening—No. 641 on Map II.

On east bank of Road Fork of Strange Creek, 1.4 miles southeast of Dille; No. 5 Block (Lower Kittanning) Coal; elevation, 1420′ B.; coal, opening closed, thickness not learned, but its stratigraphic position indicated in the Widen—3 Miles Northeast Section, page 115, since it belongs only 40 feet above Well No. 116 on Map II.

As mentioned on page 557 of Volume II(A), the No. 5 Block Coal has been quite thoroughly prospected on the 90,000-acre tract of the Cameron and Brockerhoff Estates—now mostly Elk River Coal and Lumber Company—by Capt. Baird Halberstadt, an eminent mining expert of Pottsville, Pennsylvania. This large tract of land, embracing portions of Clay, Nicholas, and Braxton Counties, lies mostly in Clay on the waters of Buffalo Creek, but extends southeastward to the divide between Elk and Gauley Rivers. Concerning the prospecting, the following by I. C. White is taken from pages 557-8 of the Volume last mentioned:

"Capt. Halberstadt's work was practically limited to tracing out and opening up for measurement and sampling this No. 5 Block Coal bed, since no others of present commercial value exist there above water level. The region is a wild one and the surface accumulations of soil and rock rubbish cover everything from sight to a depth of several feet. And yet by means of a special auger invented by himself, Capt. Halberstadt successfully traced the crop of this valuable coal bed and defined its elevation over an area of 8,500 acres, along 61 miles of outcrop, opening and proving the same at many points, thus completing in a most thorough manner, ready for mining operations, the survey of this very large coal field which has now been rendered accessible for commercial operations by the construction of several miles of branch railway on Buffalo Creek from the Coal and Coke Railway at Dundon, opposite Clay, up to where it taps the principal body of this No. 5 Block area."

The sections given for the seven following prospect openings in the No. 5 Block Coal in the Widen region, several of which were visited and verified where possible by the writer, are taken from pages 558-561 of Volume II(A) of the State Survey Reports, as also the table of analyses, which is a compilation of results obtained by McCreath, of Harrisburg, Pennsylvania, from samples collected at the same openings, except **No. 648 on Map II**:

Table Showing McCreath Analyses of No. 5 Block Coal—Pages 558-561 of Volume II(A), W. Va. Geological Survey.

No. on Map II.	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulphur	Total
644	1.033	34.925	56.141	7.077	0.824	100.000
645	1.024	36.826	56.336	5.100	0.714	100.000
646	4.016	33.324	54.747	7.350	0.563	100.000
647	1.350	35.230	52.627	9.590	1.203	100.000
649	2.020	34.580	56.433	6.360	0.607	100.000
650	1.246	36.064	57.039	4.940	0.711	100.000
Average of 6 Samples	1.782	35.158	55.554	6.736	0.770	100.000

Coal Opening—No. 644 on Map II.

On Brushy Fench Fork, 1.5 miles northeast of Widen; No. 5 Block (Lower Kittanning) Coal; elevation, 1306' L.; section by Capt. Baird Halberstadt.

			Ft.	In.
Coal	4'	0"		
Slate	0	4		
Coal	1	10	6	2

See **No. 644** in accompanying table for analysis.

Coal Opening—No. 645 on Map II.

On Road Fork of Buffalo Creek, 0.6 mile due west of No. 644; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1284' L.; section by Capt. Baird Halberstadt; See **No. 645** in table above for analysis.

			Ft.	In.
Coal	0'	4"		
Slate	0	6		
Coal	1	0		
Slate	0	6		
Coal	4	5	6	9

Coal Opening—No. 646 on Map II.

On north hillside of Buffalo Creek, ½ mile northeast of Widen; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1311' L.; section by Baird Halberstadt; See **No. 647** in table above for analysis.

			Ft.	In.
Coal	1'	1½"		
Slate	0	6		
Coal	2	3½		
Bone	0	1½		
Coal	2	3	6	3½

Coal Opening—No. 647 on Map II.

On north hillside of Buffalo Creek, ¼ mile west of Widen; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1339' L.; section by Capt. Baird Halberstadt; See **No. 647** in table above for analysis.

			Ft.	In.
Coal	0'	10 "		
Slate	0	5½		
Coal	0	5¾		
Slate	0	5		
Coal	1	6		
Slate	0	4½		
Coal	3	6½	7	7¼

Coal Opening—No. 648 on Map II.

On east hillside, ½ mile up Strickland Run of Buffalo Creek; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1369' L.; section by Capt. Baird Halberstadt.

			Ft.	In.
Coal	0'	9"		
Slate	0	5		
Coal	1	9		
Slate	0	4		
Coal	2	3	5	6

Coal Opening—No. 649 on Map II.

Edge of Nicholas County, west hillside of branch of Turkey Creek, 1.5 miles due south of Widen; **No. 5 Block (Lower Kittanning) Coal;** section by Capt. Baird Halberstadt; See **No. 649** in table above for analysis.

			Ft.	In.
Coal	0'	5 "		
Slate	0	9		
Coal	0	11½		
Slate	0	6½		
Coal	1	4		
Slate	0	8		
Coal	2	1½		
Bone	0	1		
Coal	0	9½	7	8

Coal Opening—No. 650 on Map II.

Edge of Nicholas County, east hillside of Taylor Creek, 2.2 miles S. 5° E. of Widen; **No. 5 Block (Lower Kittanning) Coal;** elevation, 1483' L.; section by Capt. Baird Halberstadt; See **No. 650** in above table for analysis.

			Ft.	In.
Coal and bone	1'	1 "		
Slate	0	8		
Coal	1	5½		
Slate	0	5		
Coal	4	2	7	9½

Capt. Halberstadt connected all his prospect openings and auger test borings in the No. 5 Block Coal with sea-level by running lines of stadia levels from a U. S. Geological Survey bench mark. The following data, taken from page 562 of Volume II(A) of the State Survey Reports is of special interest in that the interval is given at 3 points between the coal in question and the **Kanawha Black Flint:**

"Total length of outcrop line surveyed, 322,680 feet, or 61.1 miles. This does not include any of the tie lines which were run, but is the length of continuous outcrop."

	Feet.
"Elevation of Black Flint on Turkey Creek	1443
"Vertical distance between it and Big Vein (No. 5 Block)	114.5
"Elevation of Black Flint on Ramp Fork	1502.7
"Vertical distance between it and Big Vein (No. 5 Block)	109.3
"From the Big Bed (No. 5 Block) to Black Flint on Lilly Fork (Slick Rock Branch) (No. 693 on Map II) the interval (barometric) is	115-120"

Through the courtesy of Mr. J. G. Bradley, General Manager of the Elk River Coal & Lumber Company, the Survey was able to obtain the location, elevation above sea-level, and total thickness—including parting slates—of the No. 5 Block Coal in several hundred auger borings, 500 to 1500 feet apart, along the detailed outcrop survey above mentioned. The following table gives this data for **Auger Borings Nos. 651 to 677, inclusive, on Map II,** as determined by Capt. Halberstadt:

Auger Prospect Borings by Capt. Baird Halberstadt.

No. on Map II Auger Boring	Location of Auger Prospect.	No. 5 Block Coal.	
		Elevation above tide, spirit-level	Total Thickness of Bed
651	Widen, 0.4 mile north of	1298	5′ 9″
652	Widen, 0.7 mile northwest of, east hillside of Dille Run	1334	5′ 4″
653	Widen, 0.7 mile southwest of, south hillside of Buffalo Creek	1380	6′ 6″
654	On southwest side of knob, 0.3 mile east of mouth of Taylor Creek	1367	2′ 0″
655	On west hillside, 0.6 mile up Taylor Creek	1361	6′ 0″
656	On west hillside of Taylor Creek, near county line, in Nicholas County	1441	8′ 0″
657	On point northeast of mouth of Donahoe Fork of Turkey Creek, in Nicholas County	1455	5′ 5″
658	On point east of mouth of Donahoe Fork of Turkey Creek, in Nicholas County.	1446	6′ 0″
659	On north hillside of Taylor Creek, 0.7 mile southeast of Donahoe Fork, in Nicholas County	1484	2′ 11″
660	On south hillside of Turkey Creek, due south of No. 659, in Nicholas County.	1569	2′ 8″
661	On north side of Turkey Creek, 0.4 mile east of No. 659, in Nicholas County	1511	2′ 10″
662	On branch of Turkey Creek, 1 mile N. 85° E. of No. 659, in Nicholas County.	1630	2′ 3″
663	On south hillside of Turkey Creek, ¾ mile southeast of No. 659, in Nicholas County	1676	4′ 8″
664	On north hillside of Turkey Creek, 1.5 miles S. 80° E. of No. 659, in Nicholas County	1876	3′ 6″
665	On north hillside of Taylor Creek, 1 mile S. 30° E. of No. 659, in Nicholas County	1793	7′ 0″
666	On east hillside of Elm Creek, 1.2 miles southeast of Clay County Line in Nicholas County	1534	6′ 5″

No. on Map II Auger Boring	Location of Auger Prospect.	No. 5 Block Coal. Elevation above tide, spirit-level	No. 5 Block Coal. Total Thickness of Bed
667	On east hillside of Elm Creek, 0.6 mile southeast of Clay County Line, in Nicholas County	1514	4′ 3″
668	On north hillside of Buffalo Creek, 1.2 miles east of Widen, in Clay County.	1379	3′ 6″
669	On south hillside of Buffalo Creek, 0.4 mile south of No. 668, in Nicholas County	1395	2′ 5″
670	On east hillside of Buffalo Creek, 2.0 miles east of Widen, in Nicholas County	1387	7′ 0″
671	On east hillside of Buffalo Creek, 0.3 mile north of Cherry Run, in Nicholas County	1424	3′ 0″
672	On north side, ⅛ mile up Cherry Run, 2.4 miles southeast of Widen, in Nicholas County	1468	2′ 9″
673	On Cherry Run, 0.3 mile east of No. 672, in Nicholas County	1532	3′ 0″
674	On south hillside of Cherry Run, ¼ mile southwest of No. 672, in Nicholas County	1449	2′ 8″
675	On north hillside of Ramp Run, 1.2 miles southeast of No. 672, in Nicholas County	1781	4′ 4″
676	On south hillside of Ramp Run, 1.2 miles southeast of No. 672, in Nicholas County	1733	2′ 9″
677	On point southeast of mouth of Ramp Run, 3¼ miles southeast of Widen, in Nicholas County	1671	1′ 7″

The two following openings on the No. 5 Block Coal, in the southern corner of Buffalo District, were examined by Gawthrop:

Elk River Coal & Lumber Co. Coal Opening—No. 678 on Map II.

On head of Dog Run, east side of road, 0.8 mile N. 10° W. of Enoch; No. 5 Block (Lower Kittanning) Coal; elevation, 1310′ B.

			Ft.	In.
Coal, splint (shale roof)	1′	6″		
Sandstone, shaly	8	0		
Shale	2	0		
Coal, gas	0	3		
Shale, dark	0	5		
Coal, gas	0	4		
Coal, splinty (slate floor)	1	6	14	0

Coal Opening—No. 679 on Map II.

On Cow Run, just northwest of Ramsey School, ½ mile southeast of Eakle; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1340′ B.

	Ft.	In.
Sandstone, massive, gray	10	0
Coal, gas, hard	1	9
Sandstone	5	0

The No. 5 Block Coal is operated on an extensive scale near Widen in Buffalo District, Clay County, by the Elk River Coal and Lumber Company at their Rich Run Mine—**No. 677A on Map II**—on Rich Run, ¼ mile southeast of Widen, this being the only commercial mine on this bed in the territory of this Report. The following is a general section of the bed as determined by the writer at this mine:

Elk River Coal & Lumber Co. Rich Run Mine—
No. 677A on Map II.

On Rich Run, ½ mile southeast of Widen; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1350′ B.

				Ft.	In.
1.	Sandstone				
2.	Coal, semi-splint, "rooster" bench, roof of mine, 9″ bone 2″ below top, 0″ to	1′	9″		
3.	Shale, argillaceous, dark, draw slate	0	6		
4.	Coal, semi-splint, "top coal"	1	2		
5.	Slate, black, "middle band," 4″ to	0	6		
6.	Coal, splint, hard, "main bench"	4	8		
7.	Slate, black, medium-hard, "bottom slate," 12″ to	0	6		
8.	Coal, splint, "bottom coal," not taken up, 0″ to	1	6	10	7

Nos. 4, 5, and 6 constitute the "mining section", and No. 7 the pavement.

The writer measured a section, collected two samples for analysis in 1st Right Entry off 4th East, Opening 5½ of Rich Run Mine above mentioned, and obtained the following data:

				Ft.	In.
1.	Coal, "rooster," roof				
2.	Slate, dark-gray, "draw slate," 6″ to			0	8
3.	Coal, semi-splint, bright	1′	2″		
4.	Slate, black	0	6		
5.	Coal, gray splint (slate floor)	4	11	6	7

> **"Coal owned and operated by Elk River Coal and Lumber Company; principal offices, Dundon, W. Va., and Harrisburg, Pa.; capacity, 2,000 tons daily, with output of over 1,600 tons daily; men employed, 225 loaders, 16 to 20 machine runners, 16 motormen, 30 inside ordinary laborers, and 30 outside ordinary laborers; coal shipped east and west, mostly east; used for steam and domestic fuel and the manufacture of gas; mixed with Westmoreland (Pa.) coal at Philadelphia, Pa., it gave highly satisfactory results in the manufacture of gas; butts run S. 88° 30′ W.; faces, N. 1° 30′ W.; authority for mine data, R. T. Price, Superintendent."**

The composition of the sample from the mining section, including Nos. 3 and 5, is given under **No. 677A** in the table of coal analyses at the end of this Chapter as reported by Messrs. Hite and Krak under Laboratory No. 902H. The writer also collected a sample of the main bench—No. 5 only of section—at this point, the composition of which, as reported under Laboratory No. 903H, is published in the same table of analyses under **No. 677A.** The results speak for themselves as to the high-grade character of the No. 5 Block at this mine which operated 304 days during 1914 and had an output of 512,000 tons for the year, according to Superintendent Price. The writer also collected a sample of the **"bottom coal"** mentioned in the above general section of the bed at Room 1 off Fifth Opening of the Rich Run Mine, the compostiion of which, as reported under Laboratory No. 904H, is given under **No. 677A** in the table of analyses at the end of this Chapter. This bottom coal is also very pure and it is planned to take it up in some portions of the mine where the "rooster" and "top" coals of the general section have been cut away by the overlying East Lynn Sandstone, a feature that happens in South Entry off No. 5½ Opening on the divide between Pheasant Run and Turkey Creek.

Through the courtesy of Mr. R. T. Price, Superintendent of this mine, the Survey was able to get the following very complete analyses of samples collected recently from the Rich Run mine by the United States Bureau of Mines, the results of which are as follows, from samples collected by E. Russell Lloyd and chemical results by A. C. Fielder:

Coal-Analysis Report.

Lab. No. 21816. Can No. 162
Operator—Elk River Coal & Lumber Company; Rich Run Mine.
State—W. Va. County—Clay. Bed—No. 5 Block.
Town—Widen; terminal of Buffalo Creek & Gauley R. R.
Location of mine—End of 1st E. entry heading No. 5½; 2,000 ft. S. 60° E. from opening; about 800 ft. from outcrop.
Method of sampling—Standard. Net weight g. 1127.1.
Date of sampling—4-9-15. Date of Lab. sampling—4-17-15. Date analysis—4-27-15.
For B. of M. section—U. S. G. S.
Air-Dry Loss 1.5.

	Coal (Air-Dried)	Coal (As Received)	Coal (Moisture Free)	Coal (Moisture and Ash Free)
Moisture	1.51	2.49		
Volatile	35.99	35.63	36.54	39.35
Fixed Carbon	55.47	54.92	56.32	60.65
Ash	7.03	6.96	7.14	
Totals	100.00	100.00	100.00	100.00
Sulphur	.87	.86	.88	.95
Calorific Value Determined — Calories	7670	7593	7787	8396
British Thermal Units	13806	13667	14017	15095

Coal-Analysis Report.

Lab. No. 21817. Can No. 158.
Operators—Elk River Coal & Lumber Co. Mine—Rich Run Mine.
State—W. Va. County—Clay. Bed—No. 5 Block.
Town—Widen; terminal Buffalo Creek & Gauley R. R.
Location in mine—Room 15, 2nd right off S. entry No. 5½; 1200 ft. S. W. from mine mouth, about 150 ft. from outcrop.
Method of sampling—Standard. Net weight g. 1124.0.
Date of sampling—4-9-15. Date of Lab. sampling—4-7-15. Date of Analysis—4-27-15. For B. of M. section—U. S. G. S.
Air-Dry Loss 1.5.

	Coal (Air-Dried)	Coal (As Received)	Coal (Moisture Free)	Coal (Moisture and Ash Free)
Moisture	1.41	2.84		
Volatile Matter	35.34	34.83	35.85	39.15
Fixed Carbon	54.94	54.14	55.72	60.85
Ash	8.31	8.19	8.43	
Totals	100.00	100.00	100.00	100.00
Sulphur	1.11	1.09	1.12	1.22
Calorific Value Determined — Calories	7582	7472	7690	8398
B. T. U.	13648	13450	13842	15116

Coal-Analysis Report.

Lab. No. 21818-F. Composite sample of Lab. Nos. 21816 and 21817.
Operator—Elk River Coal & Lumber Co. Mine—Rich Run.
State—W. Va. County—Clay. Bed—No. 5 Block.
Town—Widen; terminal of Buffalo Creek & Gauley R. R.
Air-Dry Loss 1.2.

	Coal (Air-Dried)	Coal (As Received)	Coal (Moisture Free)	Coal (Moisture and Ash Free)
Moisture	1.43	2.64		
Volatile Matter	35.92	35.48	36.44	39.51
Fixed Carbon	55.00	54.32	55.80	60.49
Ash	7.65	7.56	7.76	
Totals	100.00	100.00	100.00	100.00
Hydrogen	5.25	5.33	5.18	5.61
Carbon	76.84	75.89	77.95	84.51
Nitrogen	1.50	1.48	1.52	1.65
Oxygen	7.77	8.76	6.58	7.13
Sulphur	.99	.98	1.01	1.10
Ash	7.65	7.56	7.76	
Totals	100.00	100.00	100.00	100.00
Calorific Value Determined — Calories	7626	7532	7736	8387
Calorific Value Determined — B. T. U.	13727	13558	13925	15097
Calculated—Calories		7612		
Calculated—B. T. U.		13702		

Coal-Analysis Report.

Lab. No. 21892—Sample of Coal—Can No. 165.
Operator—Elk River Coal & Lumber Co.
Mine—Rich Run Mine.
State—W. Va. County—Clay. Bed—No. 5 Block.
Town—Widen; terminal of Buffalo Creek & Gauley R. R.
Location in mine—2000 ft. S. 60° E. from mouth; end of 1st East entry, heading No. 5½.
Method of sampling—Standard. Net weight g. 1129.0. Date of sampling—4-9-15. Date of Lab. sampling—4-21-15. Date of analysis—5-1-15.
Air-Dry Loss 1.5.

	Coal (Air-Dried)	Coal (As Received)	Coal (Moisture Free)	Coal (Moisture and Ash Free)
Moisture	1.65	3.09		
Volatile Matter	37.00	36.46	37.62	40.12
Fixed Carbon	55.22	54.41	56.15	59.88
Ash	6.13	6.04	6.23	
Totals	100.00	100.00	100.00	100.00
Sulphur	1.51	1.49	1.54	1.64
Calories	7783	7669	7914	8439
B. T. U.	14009	13804	14245	15190

This last given represents a sample of the "rooster" coal, taken at same point as No. 21816. The results of the foregoing analyses and calorific tests of No. 5 Block Coal by the U. S, Bureau of Mines agree closely with those determined from the same mine by Messrs. Hite and Krak of the West Virginia Geological Survey.

Henry District, Clay County.

In Henry District, the thickness and stratigraphic position of the No. 5 Block (Lower Kittanning) Coal are exhibited in the sections given in Chapter IV for Valley Fork—1 Mile Southwest, Ivydale—0.5 Mile Southwest, Ivydale—1 Mile South, Clay, Laurel Fork of Lilly, and Morocco; and in the logs of wells Nos. 122 and 123 on Map II. As shown on Figure 10, its approximate minable area is confined to the southeastern two-thirds of the District, the results of test wells for oil and gas in the northwest portion, as also in the immediately adjoining regions of Otter and Union Districts, and in Roane County, tending to prove its absence in minable dimensions and regularity. Even in the area defined as minable, it is often absent entirely along the valley walls of Elk River and the immediately adjacent portions of its tributaries. It has never been mined commercially in Henry, but in the northeast edge, along Elk River, and southeast of the latter stream on the waters of Leatherwood Creek and Lilly Fork of Buffalo, it has been prospected extensively by natives for local domestic fuel and two of the large land-holding corporations; viz, the Elliott Splint Coal Company and the Elk River Coal and Lumber Company. The three following exposures and prospects, examined by Gawthrop, are on the north side of Elk River in the northeast portion of the District:

Coal Exposure—No. 680 on Map II.

East bank of Little Laurel Run, 0.9 mile north of Whetstone; No. 5 Block (Lower Kittanning) Coal; elevation, 820' B.

	Ft.	In.
Sandstone, massive, visible	15	0
Coal, splinty	1	10
Shale	2	0
Sandstone, massive, gray, hard, to run	33	0

The above exposure belongs about 140 feet below the horizon of the Upper Kittanning bed.

Coal Exposure—No. 681 on Map II.

Bed of Whetstone Run, 0.4 mile north from Elk River; **No. 5 Block (Lower Kittanning) Coal**; elevation, 770′ B.

	Ft.	In.
Sandstone, massive, visible, **East Lynn**	15	0
Coal, splint	1	6
Concealed	3	0
Sandstone, massive	15	0

The details at **Coal Opening No. 682 on Map II,** on west hillside of Elk River, 0.7 mile southeast of mouth of Two Run, **No. 5 Block (Lower Kittanning) Coal,** at an elevation of 880′ B., are given in Chapter IV with the Ivydale—1 Mile South Section, page 127.

The details at **Coal Prospect—No. 683 on Map II,** on north hillside of Cove Hollow, ¼ mile up from Leatherwood Creek—**No. 5 Block (Lower Kittanning) Coal**—at an elevation of 930′ B., are given in Chapter IV with the Section for Morocco, page 142.

Three to four miles southward in the same District (Henry), the writer obtained the following data at two different points on Leatherwood Creek:

Samuel Woods Coal Opening—No. 684 on Map II.

Northeast hillside of Leatherwood Creek, 1.2 miles due east of Right Fork; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1065′ B.

			Ft.	In.
Sandstone, shaly, visible			16	0
Sandstone, grayish-white, hard			5	0
Shale, bluish-gray, sandy, plant fossils			2	0
Coal, bony	0′	2½″		
Shale, dark-gray	0	7		
Coal, bony splint	0	7		
Coal, splint	0	11		
Coal, gray splint, hard	0	10		
Coal, splint, hard	0	10½	4	0
Slate, gray			12	0
Coal, top soft, bottom hard, reported, thickness concealed, **Little No. 5 Block—Clarion**			2	6

The above opening belongs 80 to 90 feet above the Kanawha Black Flint.

Coal Exposure—No. 685 on Map II.

On west hillside of Leatherwood Creek, 1.7 miles southeast of Right Fork; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1200′ B.

	Ft.	In
Sandstone, **Homewood**, making steep bluff......		
Concealed	10	0
Coal blossom, heavy, on bench, estimated 4′ to.	5	0
Interval to **Kanawha Black Flint horizon**........	75	0

As mentioned on a preceding page of this Chapter, immediately before the description of Opening No. 534 on Map II in the Middle Kittanning Coal, page 614, the Elliott Splint Coal Company has made a number of prospect openings in the No. 5 Block and other coal beds along Leatherwood Creek above Right Fork, many of which were closed when visited by the writer in 1915. Where the latter condition prevailed in the following openings, Mr. Krebs' detailed section is substituted and due credit given:

Coal Opening—No. 686 on Map II.

On north hillside of Leatherwood Creek, 1¼ miles southeast of Road Fork; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1465′ B.; section by C. E. Krebs.

			Ft.	In.
Coal (shale roof)..................	1′	11″		
Slate	0	4		
Coal (slate floor)..................	2	6	4	9

"Not driven under full cover."

Elliott Splint Coal Co. Coal Prospect—No. 687 on Map II.

On branch of Leatherwood Creek, ½ mile northeast of No. 686; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1400′ B.; section by Ray V. Hennen and C. E. Krebs.

	Ft.	In.
1. Sandstone, current-bedded, platy, medium-grained, **East Lynn**....................	55	0
2. Concealed and shale........................	37	0

					Ft.	In
3.	Coal, hard	2′	7″			
4.	Slate	0	3			
5.	Coal	2	6			
6.	Slate	0	8	No. 5		
7.	Coal, hard, splint	2	7	Block	8	7
8.	Slate and concealed				23	4
9.	Coal, slaty, Clarion, Little No. 5 Block				2	8
10.	Slate and concealed				70	0
11.	Kanawha Black Flint, typical				5	0

Nos. 3 to 7 of above section by Mr. Krebs, the opening being only partially exposed in 1915.

The latter collected a sample for analysis at the above opening, the composition and calorific value of which, as determined by Messrs. Hite and Krak in the State Survey Laboratory under No. 383K, are published in the table of coal analyses at the end of this Chapter under **No. 687.**

Since the field work was completed, the above prospect has been opened and driven in 50 to 60 feet, at the face of which the following section is reported by C. L. Vogelsang of the Elliott Splint Coal Company:

			Ft.	In.
Coal (slate roof)	0′	7 ″		
Slate, dark-gray	0	3		
Coal	1	10		
Bone	0	2		
Coal	2	7		
Slate, dark-gray	0	3½		
Coal, (slate floor)	2	8	8	4½

Elliott Splint Coal Co. Coal Prospect—No. 688 on Map II.

On north hillside of Leatherwood Creek, 0.4 mile southeast of Clay-Nicholas County Line; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1455′ B.; section by C. E. Krebs.

			Ft.	In.
Coal (shale roof)	0′	6 ″		
Fire clay	1	6		
Coal	0	6		
Fire clay	0	3		
Coal, hard block	3	8½		
Slate	0	0½		
Coal	0	6		
Slate	0	2		
Coal	1	0	8	2

The above opening belongs 110 feet above the crop of the **Kanawha Black Flint** as determined with aneroid by the writer, the prospect being so closed that a complete section could not be measured.

The above prospect has also recently been driven in 50 to 60 feet, at the face of which the following section is reported by Mr. Voglesang:

			Ft.	In.
Coal (slate roof)	2′	3 ″		
Bone	0	1½		
Coal	3	8		
Bone	0	5		
Coal (slate floor)	0	11	7	4½

Elliott Splint Coal Co. Coal Prospect—No. 689 on Map II.

On south hillside of Leatherwood Creek, 1.3 miles southeast of Road Fork; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1485′ B.; section by Ray V. Hennen and C. E. Krebs.

				Ft.	In.
1.	**Coal** (shale roof)	0′	5″		
2.	Slate	0	6		
3.	**Coal**	4	0		
4.	Slate	0	4		
5.	**Coal**	1	0		
6.	Slate	0	3		
7.	**Coal**, soft	0	8		
8.	Slate	0	3		
9.	**Coal**, hard splint	2	10	10	3
10.	Slate and concealed			14	0
11.	**Coal**, opening closed, **Clarion, "Little No. 5 Block,"** reported by G. W. Williams, a native, 2′ 0″ to			3	0
12.	Interval to **Kanawha Black Flint**			85	0

Only Nos. 1 to 9 of above section by Mr. Krebs.

The above prospect has also recently been opened and drvien in 50 to 60 feet, at the face of which the following section was determined by Mr. Voglesang:

			Ft.	In.
Coal (slate roof)	1′	9 ″		
Bone	0	1½		
Coal	3	11		
Slate and bone	0	4		
Coal (slate floor)	3	2	9	3½

Coal Opening—No. 690 on Map II.

On west hillside of Leatherwood Creek, ½ mile southeast of No. 686; No. 5 Block (Lower Kittanning) Coal; elevation, 1480' B.; section by I. C. White, as published in Volume II(A), page 556.

			Ft.	In.
Shale, sandy, visible			10	0
Coal	1'	4"		
Bone	0	2		
Coal	1	4		
Shale	0	3		
Coal	4	8		
Bone	0	5		
Coal	2	8	10	10
Concealed			90	0
Kanawha Black Flint			5	0
Concealed			100	0
Sandstone, very massive, gray, to bed of Leatherwood Creek			20	0

The above opening was visited by the writer and the correlations of I. C. White verified.

The two following openings on waters of Leatherwood Creek in the edge of Nicholas County were examined by the writer:

Chas. Livingood Heirs Coal Opening—No. 691 on Map II.

On west hillside of Leatherwood Creek, 0.6 mile southeast of No. 690; No. 5 Block (Lower Kittanning) Coal; elevation, 1565' B.

	Ft.	In.
Shale, sandy, visible	10	0
Coal, splint, with 3" of bone near middle	5	11
Slate and concealed to Kanawha Black Flint	95	0

The above opening was closed when visited by the writer, the section being given by G. W. Williams whose father—Sennett Williams—formerly operated it for local domestic fuel.

Melvin Williams Coal Opening—No. 692 on Map II.

On head of branch of Leatherwood Creek, 0.9 mile S. 70° E. of No. 690; No. 5 Block (Lower Kittanning) Coal; elevation, 1575' B.

			Ft.	In.
Coal, splint	2'	2"		
Coal, gray splint, hard	0	7		
Coal, splinty, bright	4	2	6	11
Slate and concealed to Kanawha Black Flint			90	0

The two following prospects on waters of Lilly Fork, in the southeastern edge of Henry District, were examined by the writer:

Elk River Coal & Lumber Co. Coal Prospect—No. 693 on Map II.

On head of branch of Lilly Fork, 0.7 mile S. 40° W. of mouth of Beech Fork; No. 5 Block (Lower Kittanning) Coal; elevation, 1440′ B.; prospect closed; 120 feet above the Kanawha Black Flint; coal reported 6 feet thick.

The details at **Elk River Coal & Lumber Coal Prospect—No. 694 on Map II,** on west hillside of Lilly Fork, 0.6 mile southeast of mouth of Beech Fork; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1485′ B.; are published in connection with the Beech Fork of Lilly Section in Chapter IV, pages 139-142.

Pleasant District, Clay County.

In Pleasant District, the thickness and stratigraphic position of the No. 5 Block (Lower Kittanning) Coal are exhibited in the sections given in Chapter IV for Dorfee, Morocco—2 Miles South, Head of Sycamore Creek, Lizemores—1.3 Miles South, Lick Branch of Adonijah, and Greendale; and in the logs of Coal Test Borings Nos. 45A, 45B, and 45C on Map II, all referenced in the Index. It appears to attain minable dimensions over the greater portion of the District, although very irregular and scanty in its occurrence in the immediate vicinity of Elk River between the mouths of Leatherwood and Little Beechy Creeks. Although never mined commercially in Pleasant, it has been prospected extensively on the waters of Middle and Sycamore Creeks by natives for local domestic fuel and the large land-holding corporations to test the value of their properties, especially by the Hartland Colliery Company. Through the courtesy of Marcy McD. Price, Vice-President and General Manager of the latter Company, the Survey was enabled to obtain a large fund of valuable information not only on the prospects in the No. 5 Block Coal, but also in the Middle Kittanning, Stockton, and Coalburg beds, along with the detailed logs of the 3 coal test borings above mentioned.

At the **Hartland Colliery Company Coal Prospect—No. 695 on Map II**—on south hillside, 0.3 mile up Cottrill Fork of Middle Creek, 2.8 miles S. 30° W. of Morocco; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1036′ L.; 2½ feet of clean coal is reported by M. McD. Price, 81 feet by spirit-level below **Prospect No. 541 on Map II** in the Middle Kittanning, and about 85 feet above the **Kanawha Black Flint** at **Prospect No.** 792 in the Stockton Coal.

One-half mile northwestward in the same District, the writer examined the following prospect:

Hartland Colliery Co. Coal Prospect—No. 696 on Map II.

On west bank of branch of Cottrill Fork; No. 5 Block (Lower Kittanning) Coal; elevation, 1022′ L.

			Ft.	In.
Shale, sandy, visible			4	0
Coal	0′	4″		
Shale, dark, siliceous	3	0		
Coal, splinty	1	10		
Coal, cannelly	0	5		
Coal, splint (slate floor)	1	8	7	3

M. McD. Price reports the following analysis and calorific tests for a sample collected from the 3 basal members at the above opening as determined by the French-Pancoast Laboratories, New York City:

	Per cent.
Moisture	0.98
Volatile Matter	45.13
Fixed Carbon	50.42
Ash	3.47
Total	100.00
Sulphur	1.15
B. T. U. (As received)	15,516
B. T. U. (Dry basis)	15,670

The calorific tests—represented by the B. T. U. results—are the highest ever reported to the State, to the writer's knowledge, for a coal bed other than those belonging in the New River and Pocahontas Groups of the Pottsville Series. This is no doubt largely due to the very low moisture and ash content in comparison with that found for coal from the same seam in southern Clay County as shown at Openings Nos. 677A, 687, and 709 on Map II.

The nine following openings in the same District (Pleasant) on the waters of Middle Creek were examined by the writer:

Coal Opening—No. 697 on Map II.

On point, east side of Middle Creek, 1.2 miles S. 15° E. of mouth of Lick Branch; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1125′ B.

			Ft.	In.
Shale, sandy, with coarse sandstone on top			4	0
Coal, semi-splint	0′	9″		
Bone	0	0½		
Coal, semi-splint	1	3½		
Coal, gray splint, hard	0	5		
Coal, semi-splint (slate floor)	1	6	4	0
Interval to **Kanawha Black Flint**			95	0

The **Samuel Stephenson Coal Opening—No. 697A on Map II**—on east hillside of Middle Creek, 1 mile southeast of mouth of Lick Branch; **No. 5 Block (Lower Kittanning)** Coal; elevation, 1110′ B.; was closed, but it belongs 95 feet above the crop of the Kanawha Black Flint and 80 to 85 feet below the Middle Kittanning Coal.

Samuel Stephenson Coal Opening—No. 698 on Map II.

On north bank of branch of Middle Creek, 0.3 mile southeast of No. 697A; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1125′ B.

			Ft.	In.
Interval from **Middle Kittanning Coal** bench			100	0
Coal, semi-splint (shale roof)	0′	7½″		
Bone	0	0½		
Coal, semi-splint	1	5		
Coal, gray splint	0	5		
Coal, semi-splint (shale floor)	1	6	4	0

Samuel Stephenson Coal Opening—No. 699 on Map II.

On east bank of branch of Middle Creek, 0.4 mile southeast of No. 697A; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1125′ B.

			Ft.	In.
Coal, semi-splint (shale roof)	0′	7½″		
Bone	0	0½		

			Ft.	In.
Coal, semi-splint	1'	5"		
Coal, gray splint, hard	0	6		
Coal, semi-splint (shale floor)	1	6	4	1

At **Coal Opening No. 700 on Map II,** on west bank of Middle Creek, at road fork, 1.3 miles south of mouth of Road Fork; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1135′ B.; only 9″ of coal is visible at base of 20 feet of massive sandstone.

Samuel Stephenson Coal Opening—No. 701 on Map II.

On branch on west side of Middle Creek, 0.2 mile southwest of Rosetta School; No. 5 Block (Lower Kittanning) Coal; elevation, 1165′ B.

			Ft.	In.
Sandstone, medium-coarse, grayish-white, East Lynn, visible			10	0
Coal, semi-splint	2'	2"		
Coal, gray splint, hard	0	4		
Coal, semi-splint (slate floor)	0	9	3	3

Richard Gibson Coal Opening—No. 702 on Map II.

On east hillside of Middle Creek, 0.2 mile south of Rosetta School; No. 5 Block (Lower Kittanning) Coal; elevation, 1163′ B.

	Ft.	In.
Sandstone, visible	5	0
Coal, opening closed, No. 5 Block, reported	4	0
Sandstone, massive	15	0
Shale, bluish-gray	4	6
Coal, Clarion, "Little No. 5 Block," at Opening No. 745 on Map II (1140′ B.)	2	6
Slate and concealed to bed of Sycamore Creek	10	0

John Legg Coal Opening—No. 703 on Map II.

On east hillside of Middle Creek, 0.5 mile south of Rosetta School; No. 5 Block (Lower Kittanning) Coal; elevation, 1180′ B.

			Ft.	In.
Sandstone, visible, coarse-grained, white, hard, East Lynn			5	0
Shale, bluish-gray, argillaceous, plant fossils			1	0
Coal, gas	0'	2"		
Shale, gray, argillaceous	0	7		
Coal, semi-splint	2	5		
Coal, gray splint, hard, slightly bony	0	5		
Coal, semi-splint	1	4	4	11

Wilburn Osborne Coal Opening—No. 704 on Map II.

On east hillside of Middle Creek, 1.0 mile south of Rosetta School; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1240′ B.

			Ft.	In.
Sandstone, visible			2	0
Shale, 0″ to			0	6
Coal, semi-splint	0′	8″		
Coal, gray splint, hard	0	5		
Coal, semi-splint	1	7		
Slate, gray, sandy, hard	0	2		
Coal, semi-splint	1	1	3	11
Slate and concealed			10	0
Coal, at opening, Clarion ("Little No. 5 Block"), thickness concealed, to base of digging			2	7

The two following openings in the same District (Pleasant) on the waters of Sycamore Creek were examined by the writer:

Hartland Colliery Co. Coal Prospect—No. 705 on Map II.

On west bank of branch of Sycamore Creek, ½ mile northwest of Clay-Nicholas County Line, in Nicholas County; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1335′ B.

			Ft.	In.
Sandstone, visible, 6′ to			8	0
Shale, dark, siliceous			4	0
Coal, splinty	1′	8 ″		
Shale, gray, argillaceous, coal streak	2	2		
Coal, splinty	0	10		
Bone, 1″ to	0	1½		
Coal, gas	1	1½		
Shale, gray, argillaceous	2	6		
Coal, splint, hard (shale floor)	3	0	11	5

The above opening is only 0.3 mile southeast from **Coal Test Boring No. 45C on Map II**, the detailed log of which is published on page 479, and in which the two main benches of the No. 5 Block Coal are separated by 12 feet of sandstone and shale.

Samuel Stephenson (Lewis Gibson) Coal Opening— No. 706 on Map II.

On east side of branch of Sycamore Creek, 0.4 mile southwest of mouth of Rock Branch, in Nicholas County; No. 5 Block (Lower Kittanning) Coal; elevation, 1440′ B.

			Ft.	In.
Shale, visible			3	0
Sandstone			1	6
Coal, semi-splint	1′	6″		
Coal, gray splint, hard	0	7		
Coal, semi-splint	1	5		
Shale, gray, 1″ to	0	2		
Coal, splinty (slate floor)	0	9	4	5

Coal Opening—No. 707 on Map II.

On head of Ash Fork of Twentymile Creek, ½ mile S. 10° W. of No. 706; No. 5 Block (Lower Kittanning) Coal; elevation, 1525′ B.; examined by the writer; was closed and thickness of bed not learned.

The three following openings, on the waters of Grassy Fork in Pleasant District, were examined by the writer:

Lesurer Heirs Coal Opening—No. 708 on Map II.

On head of Grassy Fork, 2 miles S. 70° E. of Lizemores; No. 5 Block (Lower Kittanning) Coal; elevation, 1200′ B.; opening closed, but coal reported by P. N. Stone to have practically the same thickness and character as at Opening No. 709 below.

P. N. Stone Coal Opening—No. 709 on Map II.

On north side of road, 1.6 miles N. 80° E. of Lizemores; No. 5 Block (Lower Kittanning) Coal; elevation, 1160′ B.

			Ft.	In.
1. Sandstone, visible, East Lynn			15	0
2. Coal, semi-splint, bright	2′	0″		
3. Coal, gray splint, hard	0	5		
4. Coal, semi-splint, bright	1	7	4	0
5. Slate floor				

The analysis of a sample (901H) collected by the writer from the entire bed, as reported by Messrs. Hite and Krak, is given under No. 709 in the table of coal analyses at the end of this Chapter.

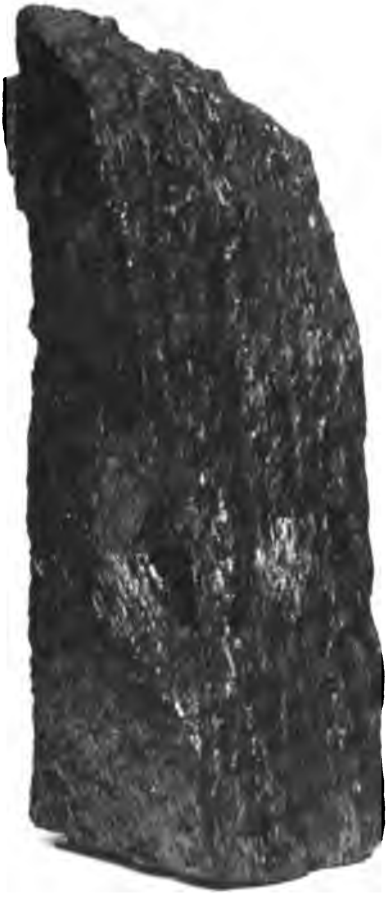

Photo by McClellan Leonard.

PLATE XXV.—Showing structure of typical splint coal from the bottom bench of the Coalburg bed at Opening No. 878 on Map II. (See page 704).

Coal from this opening has an excellent reputation as domestic fuel in the community, and the analysis is almost a duplicate of that found for the same bed at Openings Nos. 677A and 687 on Map II.

Russell Dorsey Coal Opening—No. 710 on Map II.

On east hillside of Grassy Fork, 1.3 miles due east of Lizemores; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1150′ B.

			Ft.	In.
Shale, gray, hard, **coal blossom** visible at top			1	3
Coal, semi-splint	1′	8″		
Coal, gray splint, hard	0	6		
Coal, bright, splinty (slate floor)	1	2	3	4

Hartland Colliery Co. Coal Prospect—No. 711 on Map II.

On west bank of branch of Sycamore Creek, 1¾ miles N. 40° E. of Lizemores; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1135′ B.

					Ft.	In.
Sandstone, visible					5	0
Shale, gray, argillaceous					2	6
Coal, slaty	0′	3″				
Shale, gray, sandy bottom	1	8				
Coal, slaty	0	1				
Slate, gray	0	3				
Coal, slaty	0	2				
Coal, splint	2	0	4′	5″		
Shale and concealed			5	0		
Shale			10	0		
Coal, splint, hard, at separate prospect			2	11	22	4

The above opening belongs about 100 feet below the Middle Kittanning Coal at **Prospect No. 541G** and 150 feet above the Coalburg Coal at **Prospect No. 887 on Map II.** As at **No. 705**, described above, it is split into two distinct benches by 15 feet of shale, etc.

Hartland Colliery Co. Coal Opening—No. 712 on Map II.

On branch of Right Fork of Sycamore Creek, ½ mile N. 60° E. of Lizemores; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1056′ B.; section by M. McD. Price.

			Ft.	In.
Coal	0′	5″		
Fire clay	0	4		

			Ft.	In.
Coal	0'	9"		
Sandstone	0	2		
Coal	0	3		
Fire clay	0	2		
Coal	0	3		
Sandstone	0	2		
Coal, splint	2	0	4	6

The above opening belongs about 85 feet above the **Kanawha Black Flint** cropping in an exposure at Lizemores.

The four following openings along Right Fork southeastward from Lizemores were examined by the writer:

Coal Opening—No. 713 on Map II.

On east hillside, 0.3 mile southeast of Lizemores; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1085' B.

			Ft.	In.
Sandstone, current-bedded			25	0
Coal, splint, 4" to	0'	11"		
Shale, dark-gray	0	4		
Coal and slate, mixed	0	5		
Coal, gas, hard	0	4		
Bony splint	0	3		
Coal, gas, hard	0	5		
Shale, dark-gray	0	4		
Coal, gas, hard	0	6		
Coal, splint (slate floor)	1	0	4	6

P. T. Morton Heirs Coal Opening—No. 714 on Map II.

On east hillside, 0.8 mile southeast of Lizemores; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1100' B.

			Ft.	In.
Sandstone, visible			12	0
Coal, splinty	1'	0"		
Shale, dark-gray	1	0		
Coal and slate, mixed	1	4		
Coal, semi-splint	0	10		
Shale, dark-gray	0	5		
Coal, semi-splint	1	5		
Coal, gray splint, hard	0	9		
Coal, gas, medium-hard	0	9		
Shale, gray	0	11		
Coal, semi-splint (slate floor)	1	5	9	10

The above opening belongs about 85 feet above the Kanawha Black Flint.

Homer Baker Coal Opening—No. 715 on Map II.

On east side of private road, 0.4 mile S. 15° E. of No. 714; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1120′ B.; section concealed by water; reported by Mr. Baker.

			Ft.	In.
Coal, semi-splint, hard (slate roof)	1′	9″		
Coal, gray splint, hard	0	10		
Coal, gas, soft	0	10		
Slate	0	1		
Coal (slate floor)	1	6	5	0

H. A. Walker Coal Opening—No. 716 on Map II.

On west side of road, 1.2 miles southeast of Lizemores; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1120′ B.

			Ft.	In.
Shale roof			6	0
Coal, semi-splint	1′	3″		
Coal, gray splint, hard	0	8		
Coal, gas, medium-hard	0	9		
Slate, gray	0	2		
Coal, semi-splint (slate floor)	1	4	4	2

The composition and calorific value of a sample collected at the above opening by C. E. Krebs, formerly on the State Survey Staff, as reported by Messrs. Hite and Krak, are given under **No. 716** in the table of coal analyses at the end of this Chapter.

Coal Opening—No. 717 on Map II.

On the head of Right Fork of Sycamore Creek, 1.1 miles due south of Lizemores; **No. 5 Block (Lower Kittanning) Coal**; examined by the writer; elevation, 1335′ B.; in bed of run, closed; but the position of the coal is shown in the section given in Chapter IV for Lizemores—1.3 Miles South, page 149.

Southwest and northwest from Lizemores in Pleasant District, the 3 following openings were examined by Gawthrop:

E. M. Rodgers Coal Opening—No. 718 on Map II.

On east side of road, 0.3 mile southeast of Lizemores; No. 5 Block (Lower Kittanning) Coal; elevation, 1100' B.

			Ft.	In.
Sandstone, visible			3	0
Coal, gas	0'	8"		
Fire clay shale	0	6		
Slate, coaly	0	4		
Coal	0	2		
Slate	0	2		
Coal, gas	0	3		
Slate	0	1		
Coal, gas	0	4		
Fire clay	0	6		
Coal, gas	0	8		
Coal, splint (shale floor)	0	10	4	6

The above opening belongs about 85 feet above the **Kanawha Black Flint.**

Coal Opening—No. 719 on Map II.

On west hillside of Adonijah Fork, 1 mile northwest of Lizemores; No. 5 Block (Lower Kittanning) Coal; elevation, 1025' B.

			Ft.	In.
Sandstone, shaly, flaggy, roof				
Coal, gas	0'	11"		
Bone	0	2		
Coal, gas	0	2		
Shale, gray	0	2		
Coal, gas	0	3		
Slate	0	2		
Coal, splint (slate floor)	2	0	3	10

The above opening belongs about 210 feet below the Upper Kittanning Coal.

Coal Opening—No. 720 on Map II.

On west hillside of Adonijah Fork, 1.6 miles northwest of Lizemores; No. 5 Block (Lower Kittanning) Coal; elevation, 1060' B.

	Ft.	In.
Concealed from Upper Kittanning bench	90	0
Sandstone, massive, gray, East Lynn	50	0
Concealed and sandstone	60	0
Coal, No. 5 Block, prospect closed, thickness not learned		

The 4 following openings in the western edge of Pleasant District were examined by the writer:

Coal Opening—No. 721 on Map II.

On east bank of Lick Branch of Adonijah Fork, 1.3 miles southwest of Warfield; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1080′ B.

			Ft.	In.
Sandstone, visible			2	0
Coal, bony	0′	5″		
Shale, gray, sandy	3	0		
Bone	0	6		
Coal, splint (slate floor)	1	0	4	11

The stratigraphic position of the No. 5 Block Coal in this region is shown in the Lick Branch of Adonijah Section, pages 149-153.

Elk River Lumber Co. Coal Opening—No. 722 on Map II.

On branch of Little Sycamore Creek, 0.6 mile southwest of Warfield; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1110′ B.

			Ft.	In.
Coal, slaty (sandstone roof)	0′	2″		
Coal, semi-splint	0	3		
Slate, sandy, dark	0	4		
Coal, semi-splint	0	9		
Bone, hard	0	7		
Coal, splint	0	9		
Bone, hard, 5″ to	0	6		
Coal, splint (slate floor)	1	6	4	10

Floyd Holcomb Coal Opening—No. 723 on Map II.

On east hillside of Little Sycamore Creek, 0.2 mile due south of Warfield; **No. 5 Block (Lower Kittanning) Coal**; elevation, 1090′ B.; opening closed; coal reported 4′ 0″ thick and extra fine coal, with 6″ of bone at middle.

This opening belongs 135 to 140 feet below **Coal Exposure No. 466 on Map II** in the Upper Kittanning bed, described on page 592.

Elk River Lumber Co. Coal Opening—No. 724 on Map II.

On east hillside of Little Sycamore Creek, 0.3 mile northeast of Warfield; No. 5 Block (Lower Kittanning) Coal; elevation, 1065' B.; opening closed, reported clean fine coal 2' 6" thick.

Union District, Clay County.

In Union District, the thickness and stratigraphic position of the No. 5 Block (Lower Kittanning) Coal are exhibited in the sections given in Chapter IV for Queen Shoals, Marne, Bomont—1 Mile Northwest, and Bomont—1 Mile East; and in the detailed logs published in Chapter IX for the borings sunk for oil and gas, listed below:

List of Wells Recording No. 5 Block Coal.

No. on Map II.	Thickness Feet	No. on Map II.	Thickness Feet	No. on Map II.	Thickness Feet
148	1	168	3	197	5
149	1	169	2	200	5
150	1	170	10	206	5
152	5	178	4	210	5
160	3	180	—	232	2
167	5	190	5	238	5
		192	4		

It has been prospected to some extent on Little Sycamore Creek and along the valley walls of Elk River below Birch Station on the Coal and Coke Railway, but has never been mined commercially in the District, the old commercial mine at Queen Shoals being in the Upper Kittanning bed instead of the No. 5 Block, as discussed fully on a preceding page of this Chapter under the description of the former coal in Union District, page 596. The following opening was examined by Gawthrop:

Clay Lumber Co. Coal Opening—No. 725 on Map II.

On south hillside, 0.4 mile up Buckhorn Fork of Little Sycamore Creek; No. 5 Block (Lower Kittanning) Coal; elevation, 1055' B.

	Ft.	In.
Sandstone, visible	3	0
Shale	1	0

			Ft.	In.
Coal, gas	0'	6"		
Shale, dark, slaty	0	4		
Coal, gas	0	7		
Coal, splint (shale floor)	1	8	3	1

"Coal rising rapidly southeast."

The above opening belongs about 150 feet below the Upper Kittanning Coal.

The 4 following openings in the same District (Union) are all along the valley walls of Elk River:

Coal Opening—No. 726 on Map II.

On west hillside of Elk River, ½ mile south of Rouzer; **No. 5 Block (Lower Kittanning) Coal**; elevation, 810' B.; examined by the writer.

			Ft.	In.
Sandstone, visible			10	0
Coal, semi-splint	0'	2½"		
Shale, dark-gray	0	3½		
Coal, semi-splint	1	10		
Shale, dark-gray	0	6		
Coal, slaty	0	3		
Coal, gray splint, hard (slate floor)	2	6	5	7

Otto Coal Opening—No. 727 on Map II.

On east hillside of Elk River, 0.6 mile south of Rouzer; **No. 5 Block (Lower Kittanning) Coal**; elevation, 780' B.; examined by Gawthrop.

				Ft.	In.
Sandstone, massive, visible				10	0
Coal, prospect closed, **No. 5 Block**				..	..
Concealed				45	0
Sandstone, massive				5	0
Coal, hard, gas	0'	11"	**Little No. 5 Block-Clarion**		
Coal, splint (slate floor)	1	0		1	11

The details at **Coal Opening No. 728 on Map II**, on north hillside of Elk River, opposite Marne; **No. 5 Block (Lower Kittanning) Coal**; elevation, 770' B.; are published with the section given in Chapter IV for Marne (Opposite), page 159.

Coal Opening—No. 729 on Map II.

On east side of Elk River, 0.4 mile southeast of Procious; **No. 5 Block (Lower Kittanning) Coal**; elevation, 755′ B.; examined by Gawthrop.

				Ft.	In.
Sandstone, massive, brown, visible				20	0
Coal, gas	1′	0″			
Slate, coaly	0	9			
Shale, gray	0	3			
Coal, splinty	1	0	**No. 5 Block**...	3	0
Slate and concealed				13	0
Sandstone				5	0
Coal	0′	4″			
Slate, black	0	3			
Coal, splint	0	10	**Little No. 5**		
Coal, gas	0	7	**Block—Clarion**	2	0
Slate				1	0
Concealed with sandstone, to **Coal Prospect No. 804 in Stockton** on opposite side of run, closed				45	0

Quantity of No. 5 Block (Lower Kittanning) Coal Available.

Based on the evidence given on preceding pages and a planimetric determination by Tucker from Map II of the minable area as limited on Figure 10, page 624, the following estimate is made for the probable amount of No. 5 Block (Lower Kittanning) Coal available in the area, the thickness of the bed assumed being less than half that found at many of the prospect openings in order to average up the doubtful regions of each District inside the area limited to the bed on Figure 10 above mentioned:

Probable Amount of No. 5 Block (Lower Kittanning) Coal.

Counties by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Braxton:					
Salt Lick......	3.0	34.75	22,240	2,906,323,200	116,252,928
Holly	3.5	84.90	54,336	8,284,066,560	331,362,662
Otter	2.5	32.00	20,480	2,230,272,000	89,210,880
Birch	2.5	38.00	24,320	2,648,448,000	105,937,920
Total for Braxton.		189 65	121,376	16,069,109,760	642,764,390

Counties by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Clay:					
Otter	2.5	5.10	3,264	355,449,600	14,217,984
Buffalo	3.5	57.40	36,736	5,600,770,560	224,030,822
Henry	3.0	51.35	32,864	4,294,667,520	171,786,700
Pleasant	3.5	45.95	29,408	4,483,543,680	179,341,747
Union	2.5	36.75	23,520	2,561,328,000	102,453,120
Total for Clay.....		196.55	125,792	17,295,759,360	691,830,373
Total for Both Counties...		386.20	247,168	33,364,869,120	1,334,594,763

LITTLE NO. 5 BLOCK—CLARION COAL.

The Little No. 5 Block or Clarion Coal, described briefly at the end of Chapter VII, appears to attain minable dimensions and regularity in the southeast border of Clay County, as shown on Figure 11 below. In the latter region it is the first bed below the definitely recognized No. 5 Block Coal and for that reason the qualifying name "**Little No. 5 Block**" is added, since the position in the measures of the former in the northern portion of the State is not yet absolutely established as discussed on preceding pages of this Report. In the region designated as minable, the interval separating it from the No. 5 Block bed is frequently so small—10 to 15 feet—that there is a possibility that it may represent a "split" off the latter coal. It has been prospected by natives for local domestic fuel in each County, a description of its thickness and character at these diggings being given below by magisterial districts. Its outcrop follows closely the same regions as that outlined on Map II for the No. 5 Block (Lower Kittanning) seam.

Salt Lick District, Braxton County.

In Salt Lick District, the outcrop of the Clarion Coal is confined to the waters of the Little Kanawha River above Falls Mill. In this region the two following openings, examined by the writer, appear to be on this bed:

Coal Opening—No. 730 on Map II.

On north hillside, Little Kanawha River, 0.3 mile northeast of Gregory P. O.; **Little No. 5 Block—Clarion Coal**; elevation, 980' B.: directly on top of a great sandstone ledge (Homewood); closed, but the coal is reported 18 inches thick by A. B. Gregory.

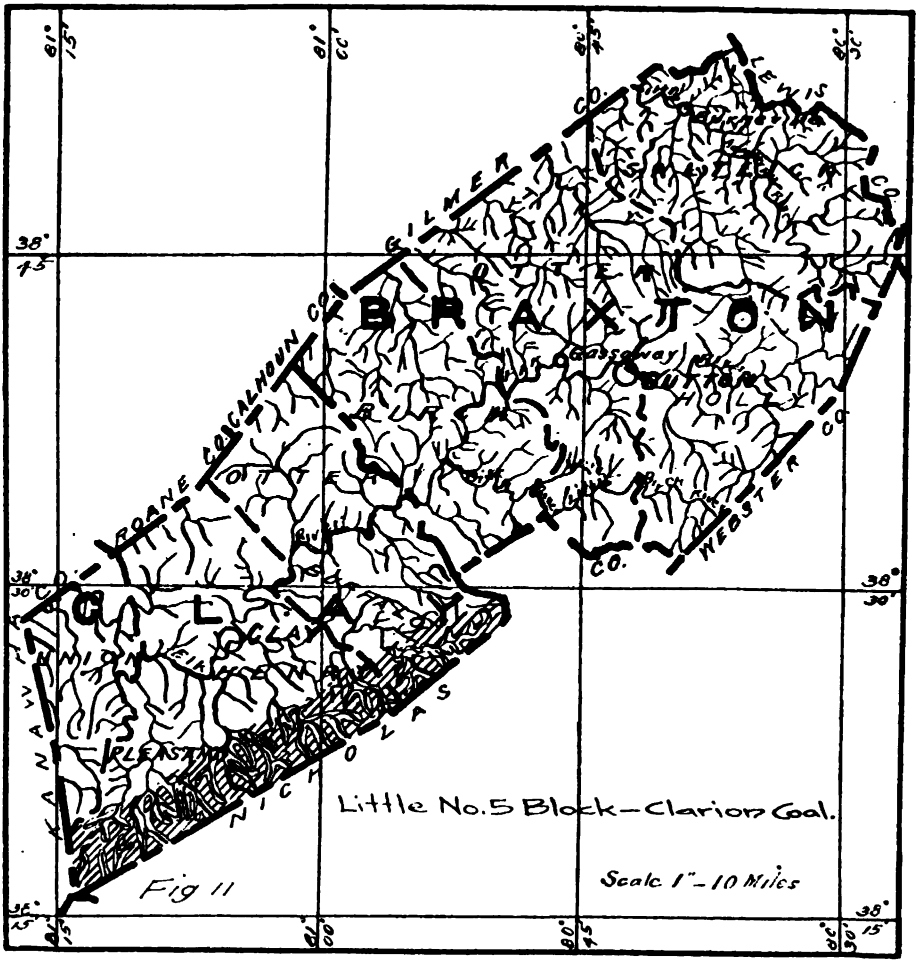

Figure 11.—Map Showing Approximate Minable Area of the Little No. 5 Block—Clarion Coal (See Explanations in Author's Preface).

Newton Fisher Coal Opening—No. 731 on Map II.

On east hillside, England Run, 0.9 mile S. 5° E. of Gregory P. O.; Little No. 5 Block—Clarion Coal; elevation, 1085' B.

			Ft.	In.
Coal (sandstone roof)	0'	3"		
Slate, black, hard, bony	0	8		
Coal, bony, 12" to	1	3	2	2
Slate and concealed			5	0
Sandstone, massive, coarse, visible, Homewood			25	0

Holly District, Braxton County.

In Holly District, the thickness and stratigraphic position of the Little No. 5 Block—Clarion Coal are shown in the section given in Chapter IV for Gillespie—1 Mile Northwest, and in the log of Coal Test Boring No. 38 on Map II, pages 96 and 470, respectively. The following opening, belonging about 100 feet above the Stockton Coal and 175 feet below the Upper Kittanning seam, was examined by the writer:

Coal Opening—No. 732 on Map II.

Located 0.2 mile southwest of Bakers Run railroad station; Little No. 5 Block—Clarion Coal; elevation, 1220' B.

			Ft.	In.
Shale, sandy, buff, visible			6	0
Sandstone, 2" to			1	3
Coal, medium-soft	0'	5"		
Coal, bony	0	7		
Shale, gray, 24" to	3	6		
Coal, slaty	0	10		
Coal, good	1	8	7	0
Slate, black, cannelly			1	3

The cannelly slate at the base of the above section is one of the characteristic features accompanying the base of the Clarion Coal in the northern portion of the State.

In the southern edge of the same District (Holly), on the waters of Little Birch River, the Clarion Coal appears to have thickened up locally into an important bed as shown in the two following openings, examined by Gawthrop, 30 to 50 feet below what seems to be the horizon of the No. 5 Block Coal. However, these are located in a forested region where correlations are somewhat uncertain:

W. N. Ellison Coal Opening—No. 733 on Map II.

On north hillside of Little Birch River, 0.8 mile S. 60° E. of Little Birch P. O.; Little No. 5 Block—Clarion Coal; elevation, 1290′ B.; closed, but coal is reported 2′ 8″ thick.

At **Coal Opening No. 734 in the No. 5 Block,** the Clarion bed is also shown (See page 640).

Otter District, Braxton County.

For the southern point of Otter District and the northern edge of Nicholas County, the thickness and stratigraphic position of the Little No. 5 Block—Clarion Coal are exhibited in the section published in Chapter IV for Mill Creek (Nicholas County), page 75. The writer collected a sample for analysis and obtained the following data at an opening that seems to belong 30 to 50 feet below the No. 5 Block Coal as the latter is represented at Herold, 5 miles westward:

W. H. Smallwood Coal Opening—No. 735 on Map II.

Mouth of branch, north side of Little Birch River, 0.9 mile S. 75° W. of Little Birch P. O.; Little No. 5 Block—Clarion Coal; elevation, 1105′ B.

			Ft.	In.
Coal, bony (sandstone roof)	0′	6″		
Coal, semi-splint, hard (slate floor)	3	2	3′ 8″ to 4	8

The analysis of a sample (No. 895H) collected from the bottom bench of above section, as reported by Messrs. Hite and Krak, is given in the table of coal analyses at the end of this Chapter under **No. 735.** The results reveal a coal of remarkable purity and justifies the great local reputation it possesses as a domestic fuel.

The Little No. 5 Block—Clarion Coal was observed by the writer in the edge of Nicholas County, on the south hillside of Mill Creek, ¾ mile southwest of Brier Run, 4.4 miles S. 15° W. of Little Birch P. O., at **Opening No. 736 on Map II,** at an elevation of 1545′ B., but the thickness was not learned.

The details at **Coal Opening No. 737 on Map II,** opposite schoolhouse, north bank of branch, ½ mile eastward from

Opening No. 736; **Little No. 5 Block—Clarion Coal**; elevation, 1560' B., are given in the Mill Creek (Nicholas County) Section, page 75.

Buffalo District, Clay County.

In Buffalo District, the Little No. 5 Block—Clarion Coal appears to attain minable dimensions in the southeastern portion as shown on Figure 11, page 682, its thickness and stratigraphic position being shown in the partial log given for Coal Test Boring No. 43 on Map II, published on page 474.

In **Auger Boring No. 738 on Map II,** on point, south side of Taylor Creek, 1.7 miles due east of Eakle, Halberstadt reports this coal 32 inches in thickness at an elevation of 1361' L., and only 12 inches thick at an elevation of 1379' L., in **Auger Boring No. 739,** one-fourth mile southeastward.

The following exposure was examined by the writer near the extreme eastern point of Buffalo District:

Coal Exposure—No. 740 on Map II.

On west bank, 0.2 mile up Road Fork, 1 mile southeast of Dille; **Little No. 5 Block—Clarion Coal**; elevation, 1315' B.

	Ft.	In.
Interval from **No. 5 Block Coal at Opening No. 640**	40	0
Shale, sandy, plant fossils, visible..............	2	0
Coal, gas, medium-soft, **Little No. 5 Block—Clarion**	1	8
Fire clay, sandstone, and sandy shale.........	10	0
Sandstone to bed of Road Fork................	3	0

Henry District, Clay County.

In Henry District, the stratigraphic position of the Little No. 5 Block—Clarion Coal is shown in the section given in Chapter IV for Cove Hollow School—2 Miles S. 10° W., page 144. The data at the two following exposures were obtained by Gawthrop:

Coal Exposure—No. 741 on Map II.

On west bank of Little Laurel Run, 0.1 mile north of Whetstone; **Little No. 5 Block—Clarion Coal**; elevation, 735' B.

	Ft.	In.
Sandstone, massive, brown, hard	18	0
Coal, splint	2	2
Shale and concealed to run	12	0

Coal Prospect—No. 742 on Map II.

On east bank of Whetstone Run, ⅛ mile from Elk River, and ⅛ mile N. 80° E. of Opening No. 741; **Little No. 5 Block—Clarion Coal**; elevation, 730' B.

	Ft.	In.
Sandstone, massive, visible	15	0
Shale, gray	6	0
Coal, prospect, concealed, about	2-	0
Concealed to Whetstone Run	3	0

In the southeastern edge of the same District (Henry), its thickness and position are exhibited in the sections given with the descriptions of **Openings Nos. 687 and 689 on Map II,** in the No. 5 Block Coal, pages 664 and 665, respectively.

Pleasant District, Clay County.

In Pleasant District, the thickness and position of the Little No. 5 Block—Clarion Coal are shown in the logs of **Coal Test Borings Nos. 45A and 45B on Map II,** published on pages 476 and 478, respectively. It has been prospected considerably by natives for local domestic fuel on the waters of Middle Creek as exhibited at the 5 following openings examined by the writer:

Coal Prospect—No. 743 on Map II.

On north bank of Devils Den Branch, 0.7 mile southwest of Cove Hollow School; **Little No. 5 Block—Clarion Coal**; elevation, 970' B.

	Ft.	In.
Coal (fire clay roof)	1	9
Shale	1	0
Sandstone, grayish-white, **Homewood**, to bed of branch	35	0

The above opening belongs 50 to 60 feet above the **Kanawha Black Flint.**

Samuel Daniels Coal Opening—No. 744 on Map II.

On west bank of Middle Creek, 0.1 mile north of Rosetta School; Little No. 5 Block—Clarion Coal; elevation, 1130' B.

	Ft.	In.
Sandstone, massive, (slate on top)	1	4
Slate, bluish-gray	4	6
Coal, gas, medium-hard (slate floor)	1	7

The details at **Coal Opening No. 745 on Map II,** on east bank of Middle Creek, 0.2 mile south of Rosetta School; **Little No. 5 Block—Clarion Coal;** elevation, 1140' B.; are given with the description of **Opening No. 702** in the No. 5 Block bed, page 670.

John Legg Coal Opening—No. 746 on Map II.

On east bank of Middle Creek, 0.4 mile south of Rosetta School; Little No. 5 Block—Clarion Coal; elevation, 1160' B.; opening closed (20 feet under Lower Kittanning—No. 5 Block Coal), reported 2' to 3' thick.

Wilburn Osborne Coal Opening—No. 747 on Map II.

On east bank of Middle Creek, one mile south of Rosetta School; Little No. 5 Block—Clarion Coal; elevation, 1250' B.

	Ft.	In.
Shale, sandy, visible	2	0
Sandstone, massive	1	4
Shale, sandy, bluish-gray	2	0
Coal, semi-splint, (shale floor)	2	10

Union District, Clay County.

In Union District, no exposures of the Little No. 5 Block—Clarion Coal were observed, but a good thickness—4' 8"—of coal is shown at this horizon in the detailed log of **Coal Test Boring No. 48 on Map II,** published on page 483 in this Chapter.

Quantity of Little No. 5 Block—Clarion Coal Available.

Based on the evidence given above and a determination by Tucker from Map II of the minable area as limited on Figure 11, the following estimate is made for the probable amount of Little No. 5 Block—Clarion Coal available in the area, the thickness of the bed assumed being less than half that found at some of the openings, in order to average up some of the doubtful regions:

Probable Amount of Little No. 5 Block—Clarion Coal.

Clay County by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Buffalo	1.5	12.65	8,096	528,992,640	21,159,705
Henry	1.5	18.70	11,968	781,989,120	31,279,565
Pleasant	1.5	26.05	16,672	1,089,348,480	43,573,939
Total for Clay County and Area		57.40	36,736	2,400,330,240	96,013,209

MINABLE COALS OF THE KANAWHA GROUP, POTTSVILLE SERIES.

STOCKTON COAL.

The Stockton Coal, described briefly in Chapter VIII, page 257, is quite an important bed in the territory of this Report. Its approximate minable area is outlined on Figure 12 below, and its outcrop follows closely the same regions as that outlined on Map II for the Coalburg seam. It has never been mined commercially in either County but in the southeast portion of each it has been prospected quite extensively by natives for local domestic fuel and by the large land-holding companies to test the worth of their properties. Its thickness and character at these diggings will now be discussed by magisterial districts.

Salt Lick District, Braxton County.

In Salt Lick District, the thickness and stratigraphic position of the Stockton Coal are exhibited in the sections given in Chapter IV for Bablin, Gregory, and Wildcat, pages 51, 55, and 56, respectively; and in the log of **Well No. 34 on Map II**—0.2 mile north of Copen--the details of which are published on page 303. It has been prospected by natives to some extent along the Little Kanawha River, the 3 following openings being examined by the writer:

James V. Gregory Coal Opening—No. 748 on Map II.

On north bank of Little Kanawha River, at Gregory P. O.; just above England Run; **Stockton Coal**; faces, N. 10° E.; butts, S. 80° E.; elevation, 855' B.

	Ft.	In.
Sandstone, making great cliff, **Homewood**	60	0
Shale, visible, dark-gray, argillaceous	10	0
Coal, slaty (slate floor)	2	4

See Gregory Section in Chapter IV, page 55, for the position of the Stockton Coal in this locality.

A. B. Gregory Coal Opening—No. 749 on Map II.

On north bank of Little Kanawha River, 0.3 mile northeast of Gregory P. O.; **Stockton Coal**; elevation, 855' B.

			Ft.	In.
Sandstone, visible			5	0
Shale, dark-gray			2	6
Coal, slaty	0'	5"		
Slate, with coal streaks	0	7		
Coal	1	2		
Slate, gray	0	2		
Coal	0	3		
Slate, gray	0	3		
Coal	0	5	3	3
Sandstone, visible			1	0

Coal Digging—No. 750 on Map II—just west of road at bend, 1.3 miles S. 50° E. of Gregory P. O.; **Stockton Coal**; elevation, 1035' B.; was closed, but appearances indicate a bed section of 3 to 4 feet.

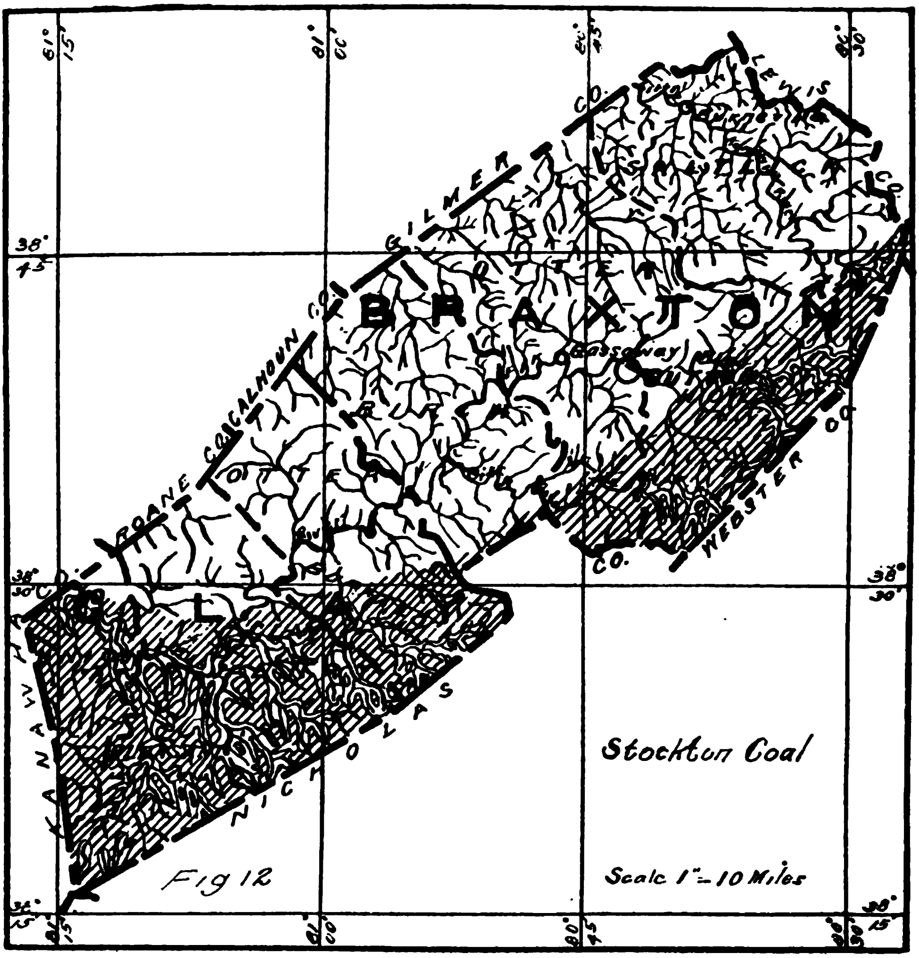

Figure 12.—Map Showing Approximate Minable Area of the Stockton Coal (See Explanations in Author's Preface.

Coal Exposure—No. 751 on Map II.

On east bank of Glady Creek, 1 mile north of Bablin, Lewis County; **Stockton Coal**; elevation, 1085' B.; examined by the writer.

				Ft.	In.
Shale, dark, with ferriferous limestone nodules and marine fossils	10'	0"	**Kanawha Black Flint**	10	6
Sandstone, and slate, dark, marine fossils	0	6			

			Ft.	In.
Coal, bony	0'	5"		
Shale, gray	0	8		
Coal, good	0	4	1	5
Fire clay shale, gray			7	0
Sandstone, flaggy, to Glady Creek			11	0

The stratigraphic position of the Stockton at the above exposure, showing the coal multiple-bedded instead of single-, is exhibited in the Bablin Section, page 51.

Holly District, Braxton County.

The thickness and stratigraphic position of the Stockton Coal in Holly District are exhibited in the sections given in Chapter IV for Palmer, Holly—¼ Mile Southwest, Marpleton, and Centralia; in the log of the J. B. Marple Well No. 109C on Map II, published on pages 341-342; and in the record of the Barley Fisher Boring No. 38 on same map, page 470. As shown on Figure 12, it attains minable dimensions and regularity in the southeastern two-thirds of the District where it has been prospected considerably by natives for local domestic fuel. Its correlation in this region is definitely established by characteristic Kanawha Black Flint marine fossils in its siliceous roof shales. As in the type locality of the Stockton, the bed usually carries 8 to 12 inches of medium-hard gas coal at the top, which is separated by shale partings from more or less splinty coal at the bottom. The 17 following openings, scattered throughout the District, were examined by the writer:

Coal Opening—No. 752 on Map II.

On north bank of Elk River, opposite mouth of Canoe Run, 0.3 mile northwest of Gillespie; Stockton Coal; elevation, 875' B.

			Ft.	In.
Sandstone, shaly			8	0
Coal, bony	1'	0"		
Shale, gray	0	7		
Coal, bony	0	10		
Shale, gray	0	4		
Coal, bony	0	11		
Shale, gray, concealed, and coal	5	0	8	8
Sandstone, shaly, to Elk River			8	0

Coal Opening—No. 753 on Map II.

Just north of mouth of Bens Run, at Gillespie; **Stockton Coal**; elevation, 910′ B.

			Ft.	In.
Shale, sandy, dark, plant fossils			10	0
Coal, gas	0′	7″		
Shale, gray	0	1		
Coal	0	1		
Fire clay shale, dark	0	5		
Coal, slaty	2	6		
Shale, dark-gray	1	8		
Coal, semi-splint	2	6	7	10
Concealed			4	0
Shale			10	0
Slate, black, coaly streaks			2	0
Fire clay shale			3	6
Sandstone, shaly			10	7
Coal, Coalburg (Opening No. 810)			1	5

Coal Opening—No. 754 on Map II.

On south bank of Elk River, due south of No. 753 above; **Stockton Coal**; elevation, 935′ B.

			Ft.	In.
Coal, gas, visible	0′	5″		
Shale	0	5		
Coal, slaty	2	0		
Shale, dark-gray	1	8		
Coal, bony	0	4		
Coal, good, semi-splint (slate floor)	1	10	6	8

Coal Opening—No. 755 on Map II.

On east bank of a south branch of Elk River, ½ mile southeast of Gillespie; **Stockton Coal**; elevation, 955′ B.

			Ft.	In.
Shale, dark, flaggy, sandy, laminated, visible			8	0
Coal, gas	0′	7″		
Shale	0	1		
Coal	0	1		
Shale, dark-gray	0	3		
Coal, slaty	1	0		
Coal, better	1	6		
Shale, dark-gray	1	3		
Coal, bony	0	3		
Coal, good, semi-splint (slate floor)	1	9	6	9

Coal Opening—No. 756 on Map II.

On north hillside of Elk River, at Holly Junction; **Stockton Coal**; elevation, 955′ B.; closed, but coal reported slaty and 3 feet thick.

Coal Opening—No. 757 on Map II.

On east hillside of branch, ½ mile N. 25° E. of mouth of Holly River; **Stockton Coal**; elevation, 1010′ B.

			Ft.	In.
Coal, gas (black sandy slate roof)	0′	9″		
Slate, coaly	0	6		
Coal, splinty, visible	1	11		
Concealed by water to floor	0	7	3	9

The details at **Coal Opening No. 758 on Map II**, on northwest hillside of Holly River, just northeast of Palmer; **Stockton Coal**; elevation, 1035′ B., are given with the Palmer Section in Chapter IV, pages 97-98.

Vernie Gibson Coal Opening—No. 759 on Map II.

In ravine, east side of Right Fork of Holly River, 0.6 mile S. 55° E. of Holly; **Stockton Coal**; elevation, 1280′ B.

			Ft.	In.
Coal, medium-hard, gas (shale roof)	0′	7″		
Coal, bony	1	7		
Coal, medium-hard, splinty (slate floor)	1	3	3	5

W. E. Yeager Coal Opening—No. 760 on Map II.

On west bank of Kanawha Run, 0.9 mile north of Holly; **Stockton Coal**; elevation, 1065′ B.

			Ft.	In.
Coal, medium-hard, gas (shale roof)	0′	9″		
Slate, black, cannelly	1	7		
Coal, slaty	1	7		
Slate, coaly	0	3		
Coal, good	0	9		
Shale, dark-gray, medium-soft	2	5		
Coal, medium-soft, good (shale floor)	1	5	8	9

Coal Opening—No. 761 on Map II.

On east side of road and branch, 0.2 mile northeast of No. 760 above; **Stockton Coal**; elevation, 1075′ B.

			Ft.	In.
Shale, sandy and dark			15	0
Coal, gas	1′	0″		
Coal, bony	1	2		
Coal, very slaty	1	9		
Coal, semi-splint, visible	2	4	6	3

A. Shreve Coal Opening—No. 762 on Map II.

On east bank of branch, 0.8 mile S. 45° W. of Replete, and 0.1 mile southeast of Saffles Retreat School; **Stockton Coal**; elevation, 1500' B.

			Ft.	In.
Shale, sandy, visible			5	0
Slate, sandy, dark			1	3
Coal, bony	2'	1"		
Coal, good (slate floor)	0	10	2	11

Coal Opening—No. 763 on Map II.

On southwest side of knob, 0.3 mile north of Bakers Run Station; **Stockton Coal**; elevation, 1125' B.

			Ft.	In.
Shale, visible, dark			0	6
Coal, gas	1'	2"		
Shale, gray	2	6		
Coal, bony	2	0		
Coal, medium-soft	1	6		
Shale, gray	4	6		
Cannel slate, **coaly**	1	7		
Coal, medium-soft (shale floor)	1	0	14	3

George Miller Coal Opening—No. 764 on Map II.

On west bank of branch of Bakers Run, ¾ mile southwest of Bakers Run Station; **Stockton Coal**; elevation, 1135' B.

			Ft.	In.
Sandstone, flaggy (**coal blossom** at top)			1	2
Coal	0'	0½"		
Shale, black	0	9		
Coal, bony	1	7		
Coal, good	1	5	3	9½
Slate and concealed by water				

H. L. Robinson Coal Opening—No. 765 on Map II, on branch of Mill Creek, 0.9 mile due south of Bakers Run Station; **Stockton Coal**; elevation, 1270' B., was closed, but reported 3 feet thick by W. T. Diggins (much bony coal on dump).

The details at **Coal Opening—No. 766 on Map II**, on branch of Laurel Creek, ½ mile southwest of Centralia; **Stockton Coal**; elevation, 1400' B., are given with the section in Chapter IV for Centralia, pages 101-3.

Dick Knight Coal Opening—No. 767 on Map II.

On north bank of Lick Creek, 1.3 miles due west of Custis; **Stockton Coal**; elevation, 1315' B.

			Ft.	In.
Sandstone, visible			2	0
Coal, slaty	0'	3"		
Shale, gray	0	2		
Coal, soft, bright	0	3		
Shale, bluish-gray, with coal streak, visible	1	3		
Concealed, but coal reported	4	0	5	11

Coal Opening—No. 768 on Map II.

On south bank of Lick Creek, opposite No. 767 above; **Stockton Coal**; elevation, 1315' B.

			Ft.	In.
Sandstone, medium-grained, micaceous, visible			15	0
Coal, gas	0'	3"		
Shale, dark-gray	0	5		
Coal, bony	0	8		
Coal, medium-hard	2	4		
Shale, light-gray	0	2		
Coal (slate floor)	0	2	4	0

The details at the **D. L. Evans Coal Opening—No. 769 on Map II,** in ravine, west side of Carpenter Fork, 1.4 miles southeast of Little Birch P. O.; **Stockton Coal**; elevation, 1320' B., are given in Chapter IV with the Little Birch—1.3 Miles Southeast Section, page 106.

The **Jas. A. Cutlip Coal Opening—No. 769A on Map II,** examined by Gawthrop on a north branch of Little Birch River, 0.7 mile N. 20° W. of mouth of Bluelick Run; **Stockton Coal**; elevation, 1370' B., was closed, but coal is reported medium-soft and 2 feet thick. This opening belongs about 230 feet below the Upper Kittanning Coal.

Otter and Birch Districts, Braxton County.

In Otter and Birch Districts, the Stockton Coal lies entirely below drainage, but its stratigraphic position is shown in the logs of Wells Nos. 74, 92, and 100 on Map II, the details of which are published in Chapter IX, pages 315, 328, and 331, respectively. These borings, located in the Rosedale region, are all of the churn drill type, and for that reason are very unreliable as to the thickness and character of the coals encountered, and in view of its absence from the records of a large number of wells scattered throughout the barren region indicated for this bed on Figure 12, page 690, it is believed that the minable area as outlined on the latter is in close harmony with the facts. Since it does not outcrop in either Otter or Birch, it has not been prospected there by the natives.

Buffalo District, Clay County.

In Buffalo District, the thickness and stratigraphic position of the Stockton Coal are shown in the logs of the Elk River Coal and Lumber Company Well No. 115 on Map II, and the William Murphy Coal Test Boring No. 43 on Map II, published on pages 354-5 and 474, respectively. These, in connection with the bed's development at crop exposures in the adjoining District (Henry), constitute the principal data on which the minable area is based on Figure 12 for the Stockton Coal in Buffalo, since the two following exposures, examined by Gawthrop, are the only ones observed in the District:

Coal Exposure—No. 770 on Map II.

In Sand Fork of Buffalo Creek, ½ mile up; near stream level; **Stockton Coal**; elevation, 845′ B.

	Ft.	In.
Sandstone, massive, **Homewood**	30	0
Shale, concealed, and shale	10	0
Shale, with iron ore	1	0
Coal, gas	0	7
Shale to run	1	0
Interval to **Coalburg Coal**, 30′ to	35	0

Coal Exposure—No. 771 on Map II.

In road, 1 mile northwest of Cressmont; **Stockton Coal**; elevation, 890′ B.

			Ft.	In.
Sandstone, massive, cliff, **Homewood**, visible			60	0
Concealed			10	0
Shale			10	0
Coal	0′	8″		
Slate	0	5		
Cannel slate (fire clay shale floor)	0	8	1	9

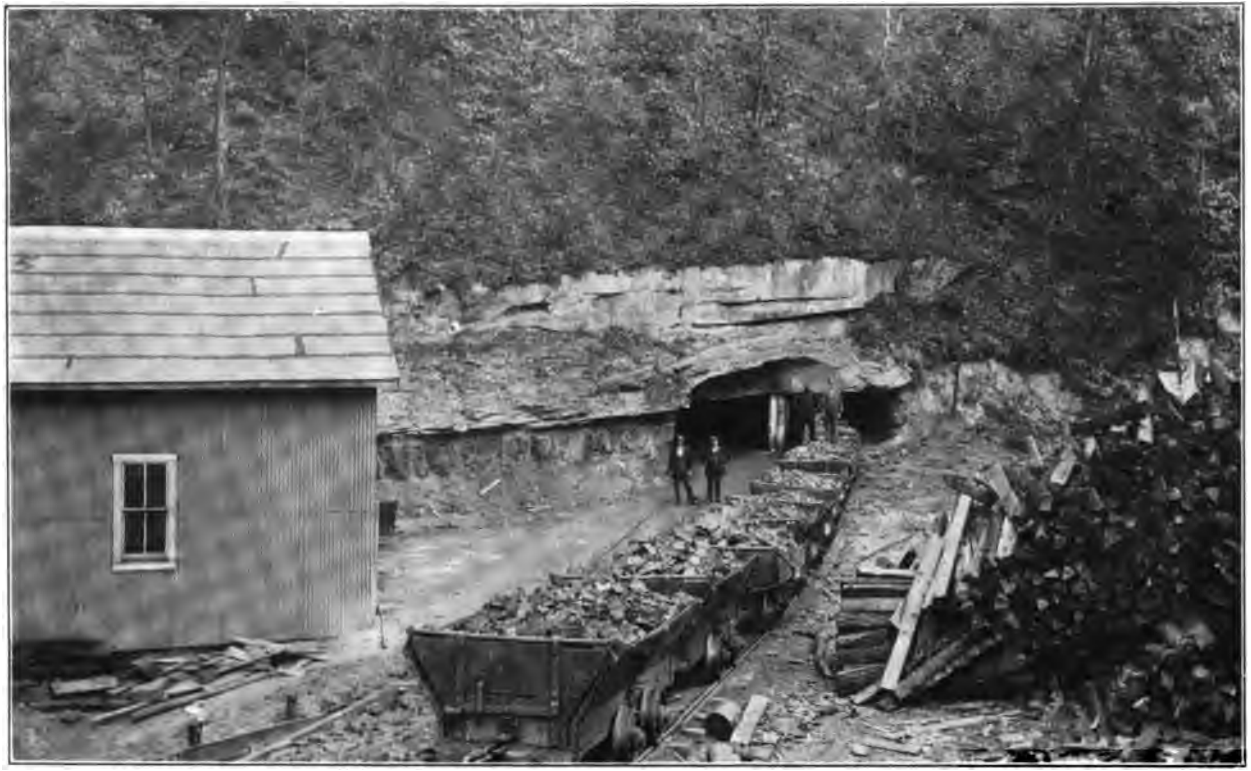

Photo by McClellan Leonard.

PLATE XXVI.—Showing Upper Coalburg Sandstone and Coalburg Coal at the entrance to the Pisgah Run Mine —No. 848 on Map II—of the Elliott Splint Coal Co. (See page 725).

Henry District, Clay County.

In Henry District, the thickness and position in the measures of the Stockton Coal are exhibited in the sections given in Chapter IV for Ivydale—0.5 Mile Southwest, Ivydale—1 Mile South, Dundon, Clay, and Sinnett Branch of Lilly Fork. As shown on Figure 12, it attains minable dimensions and regularity over a large portion of the District. It has never been mined commercially in Henry, but the natives and large land-holding companies have prospected it considerably on Leatherwood Creek, Lilly Fork, and Elk River. The Kanawha Black Flint fossils in the roof shales of the following opening in the northeast border of the District confirm the correlations of the coal at Openings Nos. 802 and 821 on Map II in the immediate vicinity with the Coalburg bed:

Coal Opening—No. 772 on Map II.

On east bank of Wallowhole Fork, 1 mile S. 30° W. of Cressmont; Stockton Coal; elevation, 935′ B.

	Ft.	In.
Sandstone, massive, coarse-grained, white and brown, about	50	0
Sandstone, flaggy, and shaly bottom	13	0
Shale, bluish-gray, marine fossils abundant, **Kanawha Black Flint**	0	3
Coal, gas, medium-hard	1	5
Shale and concealed to Wallowhole Fork	6	0

Coal Exposure—No. 772A on Map II.

On Sinnett Branch of Lilly Fork, 1.5 miles S. 20° E. of Avoca; Stockton Coal; elevation, 840′ B.; examined by Gawthrop.

	Ft.	In.
Sandstone, massive, gray, visible, **Homewood**	20	0
Shale, brown, partly concealed	8	0
Kanawha Black Flint, hard, slaty, sandy, and micaceous, with marine fossils	2	0
Coal, splinty, **Stockton**	1	4
Shale and concealed to Sinnett Branch	10	0

Coal Stripping—No. 773 on Map II.

Stripping in bed of Elk River, south bank, opposite Two Run, ½ mile southwest of Ivydale; **Stockton Coal**; elevation, 720′ B.; in Ivydale—½ Mile Southwest Section, page 126; data obtained by the writer.

	Ft.	In.
Coal, Stockton, reported by Mr. L. E. Davis as clean, soft coal in bed of Elk, when dug by him	5	0

The details at **Coal Opening No. 774 on Map II**, on southwest hillside of Elk River, 1 mile due south of Ivydale; 2 benches, **Stockton Coal**; elevation, 753′ B., are published in the section given in Chapter IV for Ivydale—1 Mile South, page 127.

The four following openings along Elk River in the same District (Henry) were examined by Gawthrop:

Okey Hopkins Coal Opening—No. 775 on Map II.

On west hillside of Elk River, ½ mile north of Standingrock railroad station; **Stockton Coal**; elevation, 800′ B.

			Ft.	In.
Sandstone, massive, visible			10	0
Coal, concealed, about			2	0
Concealed and sandstone			11	0
Shale			2	0
Coal, gas	0′	4″		
Slate	0	1		
Coal, gas	0	7		
Coal, splint (shale floor)	1	3	2	3

Coal Opening—No. 776 on Map II—on west hillside of Elk River, opposite Standingrock railroad station; **Stockton Coal**; elevation, 820′ B., was closed and thickness not learned.

Coal Opening—No. 777 on Map II.

On north side of road, just north of mouth of Lower Two Run, 1.2 miles due north of Clay; **Stockton Coal**; elevation, 710′ B.

	Ft.	In.
Sandstone, massive, visible, **Homewood**	15	0
Shale, siliceous	10	0
Coal, prospect closed, thickness not learned		

Coal Opening—No. 778 on Map II.

On west side of road and Elk River, 0.6 mile due north of Clay; **Stockton Coal**; elevation, 730′ B.

			Ft.	In.
Shale, brown, visible			5	0
Coal	2′	0″		
Coal and concealed by water	2	0	4	0

The presence of characteristic **Kanawha Black Flint marine fossils** in the following opening, examined by the writer, as also No. 782 on Map II, described on a subsequent page, establishes without doubt the position of the Stockton Coal in the vicinity of Clay and demonstrates conclusively that the bed now operated commercially at Pisgah and formerly at Dundon is the Coalburg seam:

Coal Opening—No. 779 on Map II.

On west edge of road and Elk River, 0.4 mile northwest of Dundon; **Stockton Coal**; elevation, 745′ B.

			Ft.	In.
Shale, gray, flaggy and sandy, plant fossils abundant at top, **marine fossils** bottom 6″, **Kanawha Black Flint**			6	0
Coal, gas, medium-hard	1′	1″		
Shale, gray	0	2		
Coal, gas, medium-hard	0	3		
Shale, gray	0	3		
Coal, splint	1	6		
Shale, gray	1	6		
Coal, slaty	0	2		
Shale, gray	0	3		
Coal, slaty (fire clay shale floor)	0	1	5	3
Interval to **Coalburg Coal** at Opening No. 822 on Map II			50	0

Mr. C. L. Voglesang, General Manager of the Elliott Splint Coal Company, acting on the writer's suggestion that the roof shales of the above opening in the Stockton should carry Kanawha Black Flint marine fossils, after a careful search in October, 1916, succeeded in finding these in abundance, thus clearing up a much disputed point in the correlation of the measures at this locality.

Coal Opening No. 780 on Map II, examined by the writer, in Clay town, 0.6 mile due west of Dundon; **Stockton Coal**;

elevation, 740′ B.; on east bank of ravine back of Court-House at Clay, was closed and thickness not learned.

Coal Opening No. 781 on Map II, examined by the writer, west edge of Clay, 0.9 mile due west of Dundon; **Stockton Coal**; elevation, 750′ B., was closed and thickness not learned.

Coal Opening—No. 782 on Map II.

On west side of hill road on Pisgah Run, 0.8 mile due south of Clay; Stockton Coal; elevation, 815′ B.; examined by the writer.

			Ft.	In.
Shale, sandy, dark, visible			2	6
Shale, gray, draw slate, marine fossils, Kanawha Black Flint			0	4
Coal, gas, medium-hard	1′	0 ″		
Shale, gray	0	0½		
Coal, gas, medium-hard	0	4		
Shale, gray	0	2		
Coal, gas, medium-hard	0	1½		
Shale, gray	0	0½		
Coal, gas, medium-hard	0	1½		
Shale, gray	0	0½		
Coal, gray splint	0	7	2	5½
Slate, black, sandy			0	4
Shale, gray			0	6
Sandstone, massive, Upper Coalburg, to bed of Pisgah Run			40	0

The coal at the above opening belongs about 60 feet above the Coalburg bed at the commercial mine—No. 848 on Map II—operated by the Elliott Splint Coal Company on Pisgah Run.

The 5 following prospects and openings in the same District (Henry), on the waters of Leatherwood Creek, were examined by the writer:

Elliott Splint Coal Co. Prospect Opening—No. 783 on Map II.

On north bank, 0.8 mile up Devils Den Branch of Leatherwood Creek; Stockton Coal; elevation, 910′ B.

	Ft.	In.
Sandstone, visible, Homewood	15	0
Shale, sandy	10	0
Kanawha Black Flint, slightly shaly, with marine fossils, Orbiculoidea, etc	2	0

				Ft.	In.
Coal, gas, medium-hard	1'	4"			
Shale, gray, argillaceous, 6" to	0	8			
Coal, semi-splint, 5" to	0	7			
Shale, black, 0½" to	0	1			
Coal, splint	1	7			
Bone, 0" to	0	2			
Coal, splint	1	11		6	4
Slate and concealed to Devils Den Branch				10	0

G. Fitzwater Coal Opening—No. 784 on Map II.

In north side branch of Leatherwood Creek, 0.4 mile northwest of mouth of Right Fork; **Stockton Coal**; elevation, 940' B.

				Ft.	In.
Sandstone, grayish-white, visible				5	0
Shale, concealed, and fire clay				2	6
Coal, gas	0'	3"			
Cannel, bony	1	0			
Shale, gray	0	2			
Cannel bone	0	3			
Coal, semi-splint	1	5			
Cannel, bony	0	4			
Coal, semi-splint	0	9	**Stockton "A"**	4	2
Slate, gray, and concealed				17	0
Shale, dark, sandy				5	0
Kanawha Black Flint, shaly, marine fossils abundant				2	0
Coal	0'	1"			
Shale, dark	0	1			
Coal, gas, blocky	1	2			
Shale, gray	0	5			
Coal, gas	0	3			
Shale, gray	0	5			
Coal	0	2			
Shale, gray, 5" to	0	8			
Coal, splint	0	7			
Coal, bony	0	1			
Coal, splint	2	6	**Stockton**	6	5
Slate and concealed				1	6
Sandstone, shaly				1	0
Shale, bluish-gray, iron ore nodules				3	6
Coal, bony	0'	5"			
Shale, gray	0	8			
Coal, bony, splint	0	11			
Shale, black	0	6	**Opening No. 858 on Map II**		
Coal, splint	0	5			
Shale, dark-gray	0	6			
Coal, bony	0	3	**Coalburg**	5	1
Coal, hard, splint	1	5			
Slate and concealed to bed of branch				3	0

Here the Stockton and Coalburg beds are separated by an interval of only 6 feet, or practically the same as that found at Openings Nos. 867 and 878 on Map II in the latter coal.

Coal Exposure—No. 785 on Map II.

On west side of hill road, 0.8 mile S. 85° E. of No. 784; **Stockton Coal**; elevation, 1010′ B.

			Ft.	In.
Sandstone, massive			6	0
Concealed			3	0
Shale, sandy			3	0
Kanawha Black Flint, marine fossils			2	0
Coal, gas	0′	10″		
Shale, gray, sandy	13	0		
Coal, splint (shale floor)	1	0	14	10

Coal Opening—No. 786 on Map II.

On east hillside of Leatherwood Creek, 1.1 miles northwest of mouth of Road Fork; **Stockton Coal**; elevation, 1140′ B.

	Ft.	In.
Shale, black, sandy, **marine fossils, Kanawha Black Flint, with Orbiculoidea capuliformis fossils**	5	0
Coal, splint, slightly bony (slate floor)	1	3

Elliott Splint Coal Co. Prospect—No. 786A on Map II.

On north hillside of Leatherwood Creek, 2.2 miles S. 80° E. of Road Fork; **Stockton Coal**; elevation, 1320′ B.; section by hand-level.

			Ft.	In.
Kanawha Black Flint, typical			5	0
Coal, gas, medium-hard	1′	4″		
Shale	9	1		
Coal, slaty	0	8		
Shale, gray, argillaceous	1	6		
Coal, bony, splint	0	9		
Shale, gray, argillaceous	6	0		
Coal, bony, splint, reported by G. W. Williams (slate floor)	3	6	22	10

Pleasant District, Clay County.

In Pleasant District, the Stockton Coal attains practically the same development as in Henry, its thickness and stratigraphic position being shown in the sections given in Chapter IV for Dorfee and Lick Branch of Adonijah, pages 146 and

149-53, respectively; and in the logs of Coal Test Borings Nos. 45A, 45B, 45C, and 46 on Map II, published in this Chapter on pages 476, 478, 479, and 475, respectively. Its interval above the Coalburg bed ranges from 5 feet at Dorfee to 90 feet in the Greendale region. On Middle Creek waters it has been prospected considerably by the Hartland Colliery Company, as also on Leatherwood. The 6 following prospect openings were examined by the writer:

Hartland Colliery Co. Coal Prospect—No. 787 on Map II.

On east bank of west branch of Leatherwood Creek, 0.5 mile N. 85° W. of mouth of Right Fork; **Stockton Coal**; elevation, 930' B.

				Ft.	In.
Sandstone, visible, **Homewood**				20	0
Shale, sandy				10	0
Kanawha Black Flint				1	8
Coal, gas, medium-hard	1'	2"			
Shale, gray	0	2			
Coal, gas, block	0	2	(Opening		
Shale, gray	0	3	No. 787)		
Coal, gray splint, slightly cannelly	4	0			
Slate, gray	0	5			
Coal, bony	0	6	Stockton..	6	8
Sandstone, shaly, and shale, sandy and flaggy				25	0
Coal, semi-splint	1'	9"			
Coal, slaty	0	5	(Opening		
Fire clay shale, 2" to	0	6	No. 879)		
Coal and slate	0	2			
Coal, gray splint, hard	1	11	Coalburg...	4	9

Hartland Colliery Co. Coal Prospect—No. 788 on Map II.

On a west branch of Right Fork of Leatherwood, ½ mile S. 30° E. of No. 787; **Stockton Coal**; elevation, 955' B.

				Ft.	In.
Shale, dark, sandy, visible				4	0
Kanawha Black Flint, slightly shaly, with marine fossils abundant, many species				2	0
Coal, gas, medium-hard	1'	3"			
Shale, gray	0	6	(Opening		
Coal, slaty	0	3	No. 788)		
Shale, gray	0	3½			
Coal, splint	1	0			
Bone	0	3	(Stockton)		
Coal, splint	1	9	(961' L.)...	5	3½
Shale, gray, hard, sandy				5	0

				Ft.	In.
Coal, splinty, bony	0'	5"			
Shale, dark-gray	0	11			
Coal, semi-splint	1	2	(Opening		
Shale, gray	0	2	No. 878)		
Coal, splinty	1	0	(951' L.)		
Shale, dark-gray	0	5			
Coal, gray splint, hard	1	10	Coalburg...	5	11
Slate and concealed				9	0
Shale, sandy				3	0
Coal, bony splint	2'	2"			
Sandstone	0	6			
Coal, bony splint, in bed of run, visible	1	1	Little Coalburg...	3	9

A sample for analysis was collected from the Stockton Coal—excluding shale partings—at the above prospect by McClellan Leonard, of Uniontown, Pennsylvania, on March 1, 1915, the composition of which, as determined by the French-Pancoast Laboratories of New York City, and furnished the Survey by Marcy McD. Price of the Hartland Colliery Company, is as follows:

	Sample as Received.	Calculated to Dry Basis.
Moisture	0.68	0.00
Volatile Matter	39.72	39.99
Fixed Carbon	51.65	52.00
Ash	7.95	8.01
Totals	100.00	100.00
Sulphur	1.88	1.89

The results show it almost one per cent. higher in sulphur than found in the same region for the Upper Kittanning, Middle Kittanning, No. 5 Block, and Coalburg beds, all of which are minable in Pleasant District. However, it is a valuable deposit of fuel and should be reckoned as a very important asset in summing up the coal resources of the region, although it is not now attracting much attention from the coal operators in the projected development now in progress on Middle Creek on a large boundary of about 12,000 acres lying mostly on the waters of Middle Creek and the head of Sycamore and owned by the **Hartland Colliery Company.**

Hartland Colliery Co. Coal Prospect—No. 789 on Map II.

On east bank of Middle Creek, ¾ mile southeast of mouth of Lick Branch; **Stockton Coal**; elevation, 1010′ B.

			Ft.	In.
Sandstone, visible			10	0
Concealed			4	0
Kanawha Black Flint, shaly			3	6
Coal, gas	1′	1″		
Shale, gray, sandy	0	5		
Coal, gas	0	3		
Shale, gray	0	5		
Coal, splint	1	9		
Bony splint coal, visible	0	3	4	2

Hartland Colliery Co. Coal Prospect—No. 790 on Map II.

On west bank of Middle Creek, opposite No. 789; **Stockton Coal**; elevation, 1005′ B.

			Ft.	In.
Kanawha Black Flint, slightly shaly, with marine **fossils** abundant, visible			2	0
Coal, gas, hard	1′	0 ″		
Shale, gray	0	0½		
Coal, gas	0	1		
Shale, gray, with thin coal streaks	0	4		
Coal, slaty	0	2½		
Shale, gray	0	6		
Coal, splint	1	10		
Coal, bony splint	0	6	4	6
Slate and concealed to Middle Creek			15	0

Hartland Colliery Co. Coal Opening—No. 791 on Map II.

On northwest bank, ½ mile up Lick Branch of Middle Creek; **Stockton Coal**; elevation, 1005′ B.

			Ft.	In.
Shale, sandy, dark, visible			6	0
Kanawha Black Flint, shaly, **marine fossils**			2	0
Coal, gas	1′	2″		
Shale, gray, and concealed	3	0 **Stockton**	4	2

Hartland Colliery Co. Coal Opening—No. 792 on Map II.

On south hillside, 0.4 mile up Cottrill Fork of Middle Creek; **Stockton Coal**; elevation, 945′ B.

	Ft.	In.
Shale, dark, sandy, **Kanawha Black Flint**, **marine fossils**	1	6

			Ft.	In.
Coal, gas, medium-hard	1'	1"		
Shale, gray	0	2½		
Coal, gas	0	2¾		
Shale, gray	0	1		
Coal, gray splint	2	0	3	7¼
Slate and concealed			25	0
Coal, Coalburg, at Opening No. 873 on Map II			5	1

McClellan Leonard also collected a sample for analysis of the Stockton Coal—excluding parting shales—at the above opening, the composition of which, as furnished the Survey by M. McD. Price from determinations made by the French-Pancoast Laboratories, is as follows:

	Per cent.
Moisture	1.20
Volatile Matter	35.74
Fixed Carbon	53.94
Ash	9.12
Total	100.00
Sulphur	0.85

The results show a percentage of sulphur less than half that found at Opening No. 788 on Map II in the same bed, described on a preceding page.

The section shown at the following prospect opening was measured by Marcy McD. Price. As the writer did not get to visit this locality, the correlations are based on the elevations given for the prospect openings by Mr. Price and their relation to the known structure as expressed by contours on Map II:

Hartland Colliery Co. Coal Prospect—No. 793 on Map II.

On an east branch of Middle Creek, 1.3 miles south from Elk River; Stockton Coal; elevation, 911' B.

				Thickness.		Total.	
				Ft.	In.	Ft.	In.
Shale, very fine, laminated, visible				12	0	12	0
Coal	0'	3"					
Bone	0	1					
Fire clay	0	0½					
Coal	0	6					
Fire clay	0	1	(Opening No. 793 on Map II) (911' B.)				
Coal	0	3					
Fire clay	0	0½					
Coal	0	2					
Coal, cannel	1	8					
Coal, splint	0	6	Stockton	3	7	15	7

				Thickness. Ft.	Thickness. In.	Total. Ft.	Total. In.
Sandstone, medium fine-grained and shale, sandy, plant fossils				26	0	41	7
Coal	0'	6"					
Bone	0	1	(Opening No.				
Coal, splint	1	0	871 on Map				
Coal, cannel	0	3	II) (881' B.)				
Fire clay	1	2½					
Coal, splint	1	5	Coalburg....	4	5½	46	0½
Concealed				18	0	64	0½
Coal	1'	4"					
Fire clay	0	9	Little				
Coal, splint	1	9	Coalburg....	3	10	67	10½
			(860' B.)				
Concealed				63	0	130	10½
Coal	1'	1"					
Slate	0	1½	Winifrede				
Coal	0	6	(795' B.)...	1	8½	132	7
Concealed to bed of Middle Creek (775' B.)				20	0	152	7

The details at **Coal Opening No. 794 on Map II,** on west hillside of Elk River, 0.6 mile northeast of Dorfee Station; **Stockton Coal**; elevation, 795' B., are published with the section in Chapter IV for Dorfee, page 146.

The 5 following openings and exposures in the southern portion of the same District (Pleasant) were examined by the writer:

Coal Opening—No. 795 on Map II.

East edge of trail, on Clay-Nicholas Line, 1 mile southeast of Payne Branch of Sycamore Creek; **Stockton Coal**; elevation, 1270' B.

			Ft.	In.
Kanawha Black Flint, typical			4	6
Coal, gas, medium-hard	1'	2"		
Shale, gray, sandy, iron ore nodules abundant	10	0		
Coal, splint	0	1½		
Bone	0	1½		
Coal, splinty (slate floor)	2	4	13	9

Samuel Stephenson (Lewis Gibson) Coal Opening—No. 796 on Map II.

On east bank of branch of Sycamore Creek, ⅛ mile S. 60° E. of No. 795; Stockton Coal; elevation, 1340′ B.

			Ft.	In.
Kanawha Black Flint, typical, cherty, visible, marine fossils, Orbiculoidea capuliformis....			4	6
Coal, gas........................	1′	2″		
Coal, slaty........................	0	2		
Slate and concealed................	21	0		
Coal, splint, at digging, thickness concealed, but reported 18″ to..	2	0	24	4

The base of the above opening belongs 100 feet below the No. 5 Block Coal at Opening No. 706 on Map II.

The details at **Coal Opening No. 797 on Map II,** on east bank of Right Fork of Sycamore, at Lizemores; **Stockton Coal**; elevation, 979′ B., are published in Chapter VIII under the section given at **Coal Exposure No. 65 on Map II** for the Stockton "A" Coal, the Kanawha Black Flint also being shown.

Coal Opening—No. 798 on Map II.

On north bank of Open Fork, 1¼ miles N. 20° E. of Scotford; Stockton Coal; elevation, 1120′ B.; examined by the writer; closed, but coal is reported 15 inches thick.

Coal Exposure—No. 799 on Map II, represented by blossom in road, ½ mile N. 30° W. of Greendale; **Stockton Coal**; elevation, 1160′ B., belongs 80 to 90 feet below the Coalburg bed. In this region, the relative position of the Stockton and Coalburg Coals and Kanawha Black Flint is shown in connection with Mine No. 902 on Map II, described on subsequent pages.

Union District, Clay County.

In Union District, the thickness and stratigraphic position of the Stockton Coal are exhibited in the sections given in Chapter IV for Queen Shoals and Bomont—One Mile East; and in the detailed logs published in Chapter IX for the borings sunk for oil and gas, listed in the table below:

Table Showing Thickness of Stockton Coal.

No. on Map II.	Thickness. Feet.	No. on Map II.	Thickness. Feet.	No. on Map II.	Thickness. Feet.
148	2	175	3	210	6
149	2	179	5	214	5
150	3	182	6	227	6
151A	1	183	6	228	5
155	2	188	4	228A	5
156	2	194	5	229	3
160	6	201	5	230	4
167	4	202	7	231	4
168	6	204	5	242	5
169	—	205	10	244	5
172	—	208	5		

Coal Exposure—No. 800 on Map II.

North edge of road on Wade Fork, ½ mile southeast of Shelton; **Stockton Coal**; elevation, 780' B.; examined by the writer.

	Ft.	In.
Sandstone, massive, visible	20	0
Concealed	7	0
Kanawha Black Flint, bluish-black, sandy	2	0
Coal and concealed, **Stockton**	3	0
Shale to road	7	0

The 6 following exposures and openings along Elk River in the same District (Union) were examined by Gawthrop:

Coal Exposure—No. 801 on Map II.

East hillside of Elk River, ½ mile north of mouth of Laurel Creek; **Stockton Coal**; elevation, 690' B.

		Ft.	In.
Sandstone, massive, gray, hard, visible, **Kittanning**		20	0
Coal, Clarion		0	6
Shale		0	6
Concealed		27	6
Sandstone, massive, **Homewood**		20	0
Shale, gray		1	0
Slate, black, siliceous	0' 3"		
Coal, medium-hard	0 11 **Stockton**	1	2
Shale		1	0
Concealed to Brown and Goshorn well		29	0

Coal Exposure—No. 802 on Map II.

On east bank of Twistabout Creek, 0.3 mile northeast of Marne; **Stockton Coal**; elevation, 680′ B.

	Ft.	In.
Sandstone, massive, brown, coarse, visible	25	0
Shale, dark-gray, slaty	2	0
Coal, hard, splinty (shale floor)	1	0

Coal Opening—No. 803 on Map II.

In ravine, northeast side of Elk River, ½ mile due west of Marne; **Stockton Coal**; elevation, 710′ B.

	Ft.	In.
Shale, gray	1	0
Sandstone, flaggy	4	0
Sandstone, massive	35	0
Concealed	10	0
Coal, prospect closed, **Stockton**	..	..

Coal Opening No. 804 on Map II, on the east side of Elk River, 0.6 mile due south of Procious; **Stockton Coal**; elevation, 690′ B., is given in section of **Coal Opening No. 729** in No. 5 Block bed, page 680.

Coal Opening—No. 805 on Map II.

On north bank of Porter Creek at Porter Station; **Stockton Coal**; elevation, 646′ L.

		Ft.	In.
Shale, dark, siliceous, visible		5	0
Kanawha Black Flint		8	0
Shale, dark, sandy		1	6
Coal, rotten	1′ 2″		
Fire clay	0 3		
Slate, **coaly**	0 6		
Coal, hard, splinty	1 3	3	2
Fire clay and concealed to railroad grade		2	0

Coal Exposure—No. 806 on Map II.

In road on Porter Creek, 0.8 mile southeast of Porter Station; **Stockton Coal**; elevation, 685′ B.

	Ft.	In.
Sandstone, massive, visible	15	0
Coal, very slaty, **Stockton "A"**	2	0
Sandstone, shaly	5	0
Shale, dark, siliceous	12	0
Kanawha Black Flint	9	0

				Ft.	In.
Coal	1'	1"			
Slate	0	2			
Coal	0	3			
Shale	0	6	Stockton...	2	0
Concealed				2	0
Sandstone to run				5	0

The details at **Coal Opening No. 807 on Map II,** on north bank of Elk River, opposite Queen Shoals; **Stockton Coal;** elevation, 601′ L., are given in the Queen Shoals Section, Chapter IV, page 154.

Quantity of Stockton Coal Available.

Based on the evidence given on the foregoing pages and a determination by Tucker from Map II of the minable area as limited on Figure 12, page 690, the following estimate is made for the probable amount of Stockton Coal available in the area, the thickness of the bed assumed in each magisterial district being less than half that found at many prospect openings in order to average up the doubtful regions even in the area classed as minable:

Probable Amount of Stockton Coal.

Counties by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Braxton:					
Salt Lick......	1.5	8.35	5,344	349,176,960	13,967,078
Holly	2.0	70.20	44,928	3,914,127,360	156,565,094
Otter	1.5	15.85	10,144	662,808,960	26,512,358
Birch	1.5	3.10	1,984	129,634,560	5,185,382
Total for Braxton County..		97.50	62,400	5,055,747,840	202,229,912
Clay:					
Buffalo	1.5	35.20	22,528	1,471,979,520	58,879,181
Henry	2.0	61.55	39,392	3,431,831,040	137,273,241
Pleasant	2.0	55.00	35,200	3,066,624,000	122,664,960
Union	2.0	46.00	29,440	2,564,812,800	102,592,512
Total for Clay County.....		197.75	126,560	10,535,247,360	421,409,894
Total for Both Counties...		295.25	188,960	15,590,995,200	623,639,806

COALBURG COAL.

The Coalburg Coal, described briefly in Chapter VIII, page 258, in the territory of this Report, is a very important bed commercially, its minable area, as shown on Figure 13 below, being confined to the southern portion of Clay County. It is this coal that was formerly operated on a commercial scale at Dundon and is now being worked on Pisgah Run by the Elliott Splint Coal Company, as described fully under the account of **Opening No. 799 on Map II** in the Stockton bed, page 708. Its detailed outcrop is shown on Map II. In northern Clay and in Braxton, this coal is apparently too thin and irregular in its occurrence to be of any economic worth, judged from the logs of many test wells for oil and gas penetrating its horizon and its development at outcrop exposures in the southeast portions of Salt Lick and Holly Districts. It has been prospected extensively by natives for local domestic fuel as also by the large land-holding companies. Its thickness and character at these diggings and the two commercial mines mentioned and another at Dorfee will now be described by magisterial districts.

Holly District, Braxton County.

In Holly District, the Coalburg Coal is thin and unimportant, seldom exceeding one foot in thickness. Its stratigraphic position is shown in the section given in Chapter IV for Holly —¼ Mile Southwest, page 99. The three following openings and exposures which were examined by the writer appear to represent this bed:

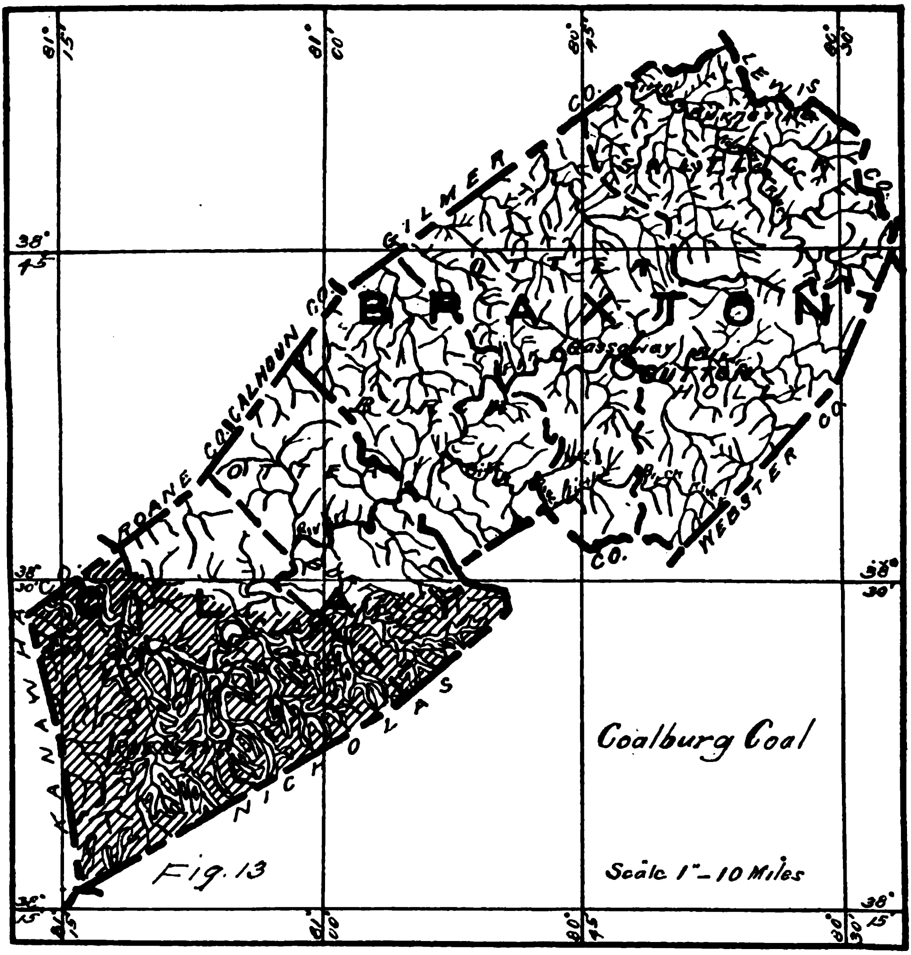

Fig. 13

Figure 13.—Map Showing Approximate Minable Area of Coalburg Coal. (See Explanations in Author's Preface).

A. B. Gregory Coal Opening—No. 808 on Map II.

On north bank of Little Kanawha River, 0.3 mile northeast of Gregory P. O.; **Coalburg Coal**; elevation, 845' B.

	Ft.	In.
Sandstone, visible (from **Stockton Coal**)........	2	0
Shale, dark..................................	1	0
Black slate, cannelly..........................	1	0
Fire clay shale................................	5	0
Shale, dark, with lenses of iron ore............	9	0
Coal, soft, **Coalburg**..........................	1	0
Sandstone to bed of Little Kanawha River......	6	0

Coal Exposure—No. 809 on Map II.

In W. Va. Midland R. R. cut, at Holly Junction; **Coalburg Coal**; elevation, 920′ L.

	Ft.	In.
Coal, Stockton, Opening No. 756	3	0
Concealed	25	0
Sandstone, shaly, and shale, sandy	11	0
Fire clay shale	3	4
Coal, Coalburg	0	8
Slate to W. Va. Midland R. R. grade	5	0

In the above exposure, the position of the Stockton Coal is definitely established by characteristic Kanawha Black Flint marine fossils in its roof shales in the immediate region, thus making the 8 inches of coal correspond to the Coalburg, since it is the first bituminous horizon below the former seam.

For details at **Coal Exposure No. 810 on Map II,** on point north of mouth of Bens Run, at Gillespie; **Coalburg Coal;** elevation, 880′ B.; see Opening No. 753 in Stockton Coal, page 692.

James A. Cutlip Coal Exposure—No. 811 on Map II.

On bank of Little Birch River, 0.5 mile S. 35° W. of Holstead P. O.; **Coalburg ? Coal**; elevation, 1355′ B.; examined by Gawthrop.

		Ft.	In.
Sandstone, massive, roof			
Coal, slaty	0′ 8″		
Coal	1 0 **Coalburg?**	1	8
Shale and concealed to Little Birch River		3	0

The above exposure belongs about 315 feet below the horizon of the Upper Kittanning bed.

In **Otter and Birch Districts,** Braxton County, and **Otter District,** Clay, the Coalburg Coal lies entirely below drainage, but the logs of borings sunk for oil and gas warrant the belief that it is either absent or too thin and scanty in its occurrence to have any economic value.

Buffalo District, Clay County.

In the southern half of Buffalo District, the Coalburg Coal attains minable dimensions and regularity, its thickness and stratigraphic position in this region being exhibited in the sections given in Chapter IV for Widen—North Edge, and Widen—3 Miles Northeast, and in the logs of test wells for oil and gas, Nos. 114 and 115 on Map II. The 3 following exposures and openings were examined by Gawthrop in the northwest edge of the District on Elk River:

Coal Exposure—No. 812 on Map II.

In Coal and Coke Railway cut, 0.3 mile southwest of Standingrock Station; **Coalburg Coal**; elevation, 750′ B.

			Ft.	In.
Sandstone, visible			15	0
Coal, splinty	1′	3″		
Coal, gray splint	0	9		
Coal, gas	0	6	2	6
Fire clay shale to railroad			2	0

The above exposure belongs about 335 feet below the horizon of the Upper Kittanning Coal.

Coal Exposure—No. 813 on Map II.

In branch, 0.2 mile due east of No. 812; **Coalburg Coal**; elevation 820′ B.

	Ft.	In.
Sandstone, visible	10	0
Coal, rotten, splinty	1	6
Concealed	5	0
Sandstone, massive	30	0
Concealed, with sandstone, to railroad grade	35	0

Coal Exposure—No. 814 on Map II.

On south bank of Standingrock Run, 0.4 mile northeast of Standingrock Station; **Coalburg Coal**; elevation, 800′ B.

			Ft.	In.
Sandstone, visible			10	0
Coal, gas	0′	9″		
Slate, coaly	0	3		
Coal, splinty	1	3	2	3
Shale and concealed			5	0
Sandstone cliff to bed of Standingrock Run			40	0

The details at **Coal Opening No. 815 on Map II,** in hill road, ¾ mile up Sand Fork of Buffalo Creek; **Coalburg Coal;** elevation, 815′ B., are published with the section given in Chapter IV, page 133, for Sand Fork—¾ Mile Northeast.

At **Coal Exposure—No. 816 on Map II,** in Buffalo Creek and Gauley R. R. cut, ¼ mile southeast of mouth of Sand Fork; **Coalburg Coal;** elevation, 840′ B., 2 feet of coal is visible, according to Gawthrop.

Coal Exposure—No. 817 on Map II.

In road, 0.3 mile east of No. 816 and 1 mile northwest of Cressmont; Coalburg Coal; elevation, 860′ B.; examined by Gawthrop.

	Ft.	In.
Coal, visible	2	0
Concealed	5	0
Sandstone, massive	25	0

The details at **Coal Opening No. 818 on Map II,** in north edge of town of Widen; **Coalburg Coal;** elevation, 1150′ B.; are published with section given in Chapter IV for Widen—North Edge, page 118.

Henry District, Clay County.

In Henry District, the thickness and stratigraphic position of the Coalburg Coal are exhibited in the sections published in Chapter IV for Wallback, Clay, Dundon, Sand Fork—0.5 Mile Southwest, Sinnett Branch of Lilly, Laurel Fork of Lilly, and Morocco; and in the logs of the oil and gas test wells Nos. 123 and 125 on Map II. It was formerly mined commercially at Dundon by the Elk River Coal and Lumber Company, and is now being operated by the Elliott Splint Coal Company on Pisgah Run, slightly less than one mile south of Clay. It has also been prospected extensively by the natives for local domestic fuel and by the large land-holding corporations on the waters of Buffalo and Leatherwood Creeks. The three following openings in the northeast edge of the District on Buffalo Creek waters were examined by the writer:

Elk River Coal and Lumber Company Coal Opening—No. 819 on Map II, on west hillside of Hickory Fork, 1 mile S. 10° W. of Cressmont; **Coalburg Coal**; elevation, 975′ B.; prospect closed; reported about 3 feet thick.

Elk River Coal & Lumber Co. Coal Opening—
No. 820 on Map II.

On south bank of Wallowhole Fork, ¾ mile southwest of Cressmont; **Coalburg Coal**; elevation, 910′ B.

			Ft.	In.
Coal blossom, Stockton, streak of coal				
Slate and concealed			15	0
Shale, dark			1	6
Coal	0′	3″		
Shale, dark-gray	0	5		
Coal	0	4		
Shale, dark-gray	0	8		
Coal and slate	0	3		
Coal, splint	1	10	3	9

The correlation of the Stockton and Coalburg beds at the above opening, as also that next below, is definitely established by characteristic **Kanawha Black Flint marine fossils** in the roof shales of the former coal at **Opening No. 772,** described on page 697.

Elk River Coal & Lumber Co. Coal Opening—
No. 821 on Map II.

On west bank of Wallowhole Fork, 0.2 mile southwest of No. 820; **Coalburg Coal**; elevation, 910′ B.

				Ft.	In.
Sandstone, massive, coarse-grained, white and brown, visible				25	0
Concealed				13	7
Coal, gas, medium-hard, Stockton				1	5
Slate and concealed and sandstone				14	0
Slate, black, plant fossils				2	6
Coal, gas, hard, 2″ to	0′	3″			
Shale, dark-gray, argillaceous, 6″ to	0	9			
Coal, semi-splint	0	6			
Shale, dark-gray, argillaceous	0	6			
Coal and slate interlaminated, 3″ to	0	4			
Coal, splint	1	9	Coalburg	4	1
Slate				0	6
Sandstone to bed of Wallowhole Fork				6	0

The following opening, examined by the writer and its horizon shown as 50 feet directly below the undoubted Stockton bed at Opening No. 779 on Map II, page 699, is operated during low-water stages of Elk River to furnish domestic fuel for the town of Clay, and is absolutely the same as the "Dundon" seam mentioned on page 443 of Volume II(A):

Thomas Hamrick (Walter Williamson, Lessee) Coal Opening—No. 822 on Map II.

On west edge and flush with bed of Elk River, ½ mile northwest of Dundon; **Coalburg Coal**; elevation, 680′ L.

			Ft.	In.
Coal, gray splint, hard (sandstone roof)	2′	2″		
Coal, gas, medium-hard, bright	0	4		
Bone, black	0	7		
Coal, gas, hard (slate floor)	1	6	4	7

The two following sections were obtained at separate drift openings of the old abandoned mine described on page 443 of Volume II(A) and wrongly correlated with the Winifrede seam:

Coal Mine (Abandoned)—No. 823 on Map II.

Old abandoned commercial mine, south bank of Fitzwater Run, 0.1 mile northwest of Dundon; **Coalburg Coal**; elevation, 720′ B.; examined by the writer.

			Ft.	In.
Coal, splinty (sandstone roof)	0′	10″		
Shale, dark-gray	0	6		
Coal, bony, slaty	0	5		
Coal, gray splint, hard	2	1		
Shale, gray, 1″ to	0	3		
Coal, semi-splint, not well exposed	2	0	6	1

Elk River Coal & Lumber Co. Dundon Mine (Abandoned)—No. 824 on Map II.

East edge of Dundon, north side of Buffalo Creek; **Coalburg Coal**; elevation, 745′ B.; examined by Gawthrop.

	Ft.	In.
Sandstone, massive, visible, **Upper Coalburg**	10′	0
Shale, gray	1	0

			Ft.	In.
Coal, splint	2′	0″		
Bone	0	1½		
Coal, gas	0	4		
Shale, gray	0	1		
Coal, gas	0	3½		
Slate	0	3		
Coal	0	6		
Bone coal	0	3		
Coal, hard	1	1	4	11
Sandstone			1	0
Shale, visible			2	0
Concealed			5	0
Sandstone, **Lower Coalburg**, massive, gray, micaceous, to railroad			27	0

The 9 following openings along Buffalo Creek, between Dundon and Sand Fork stations of the Buffalo Creek and Gauley Railroad, were examined by Gawthrop:

Elk River Coal & Lumber Co. Coal Opening—No. 825 on Map II.

On north hillside of Buffalo Creek, 0.6 mile southeast of Dundon; **Coalburg Coal**; elevation, 775′ B.

			Ft.	In.
Sandstone, partly concealed			30	0
Shale, gray			5	0
Concealed			15	0
Sandstone, massive, gray			22	0
Slate			0	3
Coal, splinty	1′	11″		
Coal, softer	0	7		
Coal, slaty	0	6	3	0
Shale, visible			1	0

Roscoe Mullens Coal Opening—No. 826 on Map II.

On north hillside of Buffalo Creek, 0.7 mile northeast of Avoca; **Coalburg Coal**; elevation, 820′ B.; closed; estimated about 3 feet thick.

Coal Opening—No. 827 on Map II.

On north hillside of Buffalo Creek, 0.6 mile S. 85° E. of Avoca; **Coalburg Coal**; elevation, 815′ B.

	Ft.	In.
Coal, rotten, character not determined, visible (shale roof)	3	0

Coal Exposure—No. 828 on Map II.

On north hillside of Buffalo Creek, 0.7 mile northeast of Avoca; **Coalburg Coal**; elevation, 810′ B.; represented by blossom on bench.

Allen Reed Coal Opening—No. 829 on Map II.

On south hillside of Buffalo Creek, opposite mouth of Chestnut Knob Branch; **Coalburg Coal**; elevation, 815′ B.

			Ft.	In.
Coal and slate, left up (shale roof)	1′	0″		
Coal, semi-splint	1	0		
Shale, dark-gray	0	5		
Slate, coal streaks	0	5		
Coal, splint, good (slate floor)	2	5	5	3

Coal Opening—No. 830 on Map II.

On north hillside of Buffalo Creek, 0.3 mile southeast of No. 829; **Coalburg Coal**; elevation, 815′ B.

	Ft.	In.
Coal, opening closed, 2 feet to	3	0
Concealed	5	0
Sandstone, **Lower Coalburg**, to railroad grade	50	0

Coal Opening—No. 831 on Map II.

On north hillside of Buffalo Creek, ¾ mile southwest of Sand Fork Station; **Coalburg Coal**; elevation, 835′ B.

	Ft.	In.
Coal, rotten, visible	2	0
Shale	2	0
Sandstone, **Lower Coalburg**, gray, micaceous, massive, broken, medium-grained, to railroad grade	48	0

Elk River Coal and Lumber Company Coal Opening—No. 832 on Map II, on south hillside of Buffalo Creek, just east of Sand Fork Station; **Coalburg Coal**; elevation, 830′ B.; closed; reported 5 feet thick with slate parting, 25 feet above railroad grade.

W. H. Nicholas Coal Opening—No. 833 on Map II.

On west hillside of Hammocks Fork, ½ mile up from Buffalo Creek; **Coalburg Coal**; elevation, 840′ B.

			Ft.	In.
Slate, black, argillaceous, with plant fossils, partly concealed			2	6
Coal, semi-splint	0′	10″		
Shale, gray	0	5		
Slate, **coaly**	0	6		
Coal, splint (slate floor)	2	4	4	1

The 9 following openings in the Coalburg Coal on the waters of Lilly Fork of Buffalo Creek were examined by Gawthrop:

Coal Opening—No. 834 on Map II.

On west hillside of Lilly Fork, 0.2 mile southwest of Avoca; **Coalburg Coal**; elevation, 820′ B.

			Ft.	In.
Shale, dark, visible			3	0
Coal	0′	8″		
Shale	0	4		
Coal, gas	0	9		
Shale	0	6	2	3
Coal and concealed by water			10	0
Sandstone, massive, **Lower Coalburg**			40	0
Sandstone, partly concealed			50	0

Elk River Coal & Lumber Co. Coal Opening—No. 835 on Map II.

On west hillside of Lilly Fork, ¾ mile due south of Avoca; **Coalburg Coal**; elevation, 795′ B.

			Ft.	In.
Coal, left up (dark shale roof)	1′	2″		
Shale, gray	0	4		
Coal, gas	0	10		
Slate	0	6		
Coal, splint	2	3		
Coal, gas	1	0		
Coal, splint	0	8	6	9
Coal and concealed				

Elk River Coal & Lumber Co. Coal Opening— No. 836 on Map II.

On west bank of Lilly Fork, ⅛ mile above Sinnett Branch; **Coalburg Coal**; elevation, 780' B.

	Ft.	In.
Shale, dark, small **coal** streaks, visible	5	0
Shale, gray	3	0
Coal, rotten, left up 2' 10"		
Coal, concealed, reported	2	10
Concealed, with sandstone, to bed of Lilly Fork	60	0

Elk River Coal & Lumber Co. Coal Opening— No. 837 on Map II.

On east bank of Lilly Fork, 0.3 mile above Sinnett Branch; **Coalburg**; elevation, 775' B.

	Ft.	In.
Sandstone, **Upper East Lynn**, massive, coarse-grained, very pebbly, visible	25	0
Sandstone, massive to flaggy, not so pebbly as above	75	0
Sandstone, flaggy, **East Lynn**	45	0
Concealed, with sandstone?	5	0
Sandstone, massive, broken	20	0
Concealed, with sandstone	155	0
Coal, opening closed, thickness not learned	...	...
Sandstone and concealed to bed of Lilly Fork	50	0

Elk River Coal and Lumber Company Coal Opening—No. 838 on Map II, on north bank of branch and 0.3 mile up Sinnett Branch of Lilly Fork; **Coalburg Coal**; elevation, 780' B.; opening closed; thickness not learned.

Elk River Coal & Lumber Co. Coal Opening— No. 839 on Map II.

On west bank of Sinnett Branch of Lilly Fork, ⅛ mile south of No. 838; **Coalburg Coal**; elevation, 790' B.

	Ft.	In.
Coal, prospect closed (sandstone roof), reported about	5	0
Sandstone, massive, visible	20	0

Elk River Coal & Lumber Co. Coal Opening—No. 840 on Map II.

On east bank of Sinnett Branch of Lilly Fork, 0.4 mile south of No. 838; **Coalburg Coal**; elevation, 795' B.

				Ft.	In.
Sandstone, visible				10	0
Concealed, holding **Kanawha Black Flint**				25	0
Sandstone				12	0
Shale				1	0
Cannel slate	1'	0"			
Slate, **coal** streaks	3	0			
Shale, black, slaty	4	0			
Coal, concealed, reported	4	0	**Coalburg**	12	0

The above opening is only 0.2 mile below No. 772A on Map II in the Stockton Coal, described on page 697, the latter showing the **Kanawha Black Flint.**

At **Coal Exposure No. 841 on Map II,** on west hillside of Lilly Fork, 0.8 mile N. 20° E. of Cove Hollow School; **Coalburg Coal**; elevation, 805' B., 3 feet of splinty weathered coal is visible.

Coal Opening No. 842 on Map II, on west hillside of Lilly Fork, 0.3 mile east of No. 841; **Coalburg Coal**; elevation, 845' B.; was closed; thickness not known.

The details at **Elk River Coal and Lumber Company Coal Opening—No. 843 on Map II,** 0.3 mile due south of mouth of Laurel Fork of Lilly Fork; **Coalburg Coal**; elevation, 1180' B., are given in the Laurel Fork of Lilly Section, page 138.

The following is the opening referred to by I. C. White at the bottom of page 443 of Volume II(A) of the State Survey Reports:

Coal Opening—No. 844 on Map II.

On south bank of Elk River, ½ mile southwest of Dundon; **Coalburg Coal**; elevation, 700' B.; section as published in Volume II(A), page 443, account of opening being closed at the time of visit.

			Ft.	In.
Coal, splint (sandstone roof)	2'	5"		
Fire clay shale	0	1		
Coal, bony	0	4		
Bone	0	3		
Coal, splint	2	9	5	10
Interval to bed of Elk River			20	0

The three following openings in the Coalburg Coal along the north side of Elk River in the same District (Henry) were examined by Gawthrop:

Coal Opening—No. 845 on Map II.

On west bank of Elk River, opposite mouth of Pisgah Run; Coalburg Coal; elevation, 705' B.

			Ft.	In.
Sandstone, massive, Upper Coalburg			10	0
Slate, coaly, left up	1'	0"		
Coal, left up	0	8		
Shale, left up	0	8		
Coal, splint	2	7		
Shale, dark	0	8		
Coal, splint	3	0		
Shale	0	3		
Coal, splint, visible	0	11	9	9

Coal Opening—No. 846 on Map II.

On west bank of Elk River, 0.1 mile southwest of mouth of Pisgah Run; Coalburg Coal; elevation, 730' B.

			Ft.	In.
Sandstone, massive, Upper Coalburg, visible			10	0
Coal, slaty	0'	3"		
Shale, dark	0	6		
Coal, splinty	0	8		
Slate	0	9		
Coal, splint	2	2		
Shale and slate	1	6		
Coal, soft	2	0	7	10
Concealed			3	0
Sandstone, massive, Lower Coalburg			30	0
Concealed to Elk River			10	0

Mary L. Burns Coal Opening—No. 847 on Map II.

On east bank, ⅛ mile up Camp Creek, 1⅛ miles southwest of Clay; Coalburg Coal; elevation, 705' B.

			Ft.	In.
Sandstone, massive, visible, Upper Coalburg			10	0
Coal	0'	11"		
Slate	0	5		
Coal	0	4		
Slate, black	0	10		
Coal, splint, good	2	3	4	9
Slate and concealed to bed of Camp Run			6	0

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No. 906H from the gas coal—Nos. 9, 11, and 15 of above section, in Room 1, 4th E. Entry.

No. 907H from the bottom or slightly bony splint coal, not taken up —No. 17 of the above section—from "rib" of 4th E. Entry, 75 feet from main straight heading.

The composition of the three samples, as determined by Messrs. Hite and Krak, are published under **No. 848** in the table of coal analyses at the end of this Chapter. The results indicate a high-grade coal, the splint type giving 14,300 B. T. U. per pound of coal. According to Mr. Voglesang, the splint is screened into both "lump" and "egg", the former type being shipped for domestic fuel only, and the latter as fuel for burning brick and tile, having an excellent reputation for this use on account of its non-coking, non-clinkering and long-flame character. The splint coal burns into red ashes, while the gas burns into white ashes.

The 7 following openings in the same District (Henry) are located along the valley walls of Elk River westward from the mine last described:

Coal Opening—No. 849 on Map II.

On south bank of Elk River, 0.7 mile southwest of No. 848; **Coalburg Coal**; elevation, 730′ B.; examined by the writer.

			Ft.	In.
Sandstone, visible			2	0
Shale, dark-gray, 0″ to			0	7
Coal, splinty	0′	8″		
Shale, dark-gray	0	4		
Coal, bony	0	5		
Bone, 0½″ to	0	1		
Coal, gas, medium-hard	0	3		
Coal and slate mixed	0	6		
Fire clay shale, gray	1	10		
Coal, gas, medium-soft	0	4		
Bone	0	5		
Bony cannel	0	8		
Coal, gas, medium-hard	1	4		
Shale, dark-gray, hard	0	6		
Coal, splint, slightly bony (slate floor)	1	5	8	9

Coal Opening—No. 850 on Map II.

On east bank of Elk, in Coal and Coke Railway cut, 0.3 mile north of mouth of Leatherwood Creek; **Coalburg Coal**; elevation, 710′ B.; examined by the writer.

			Ft.	In.
Sandstone, visible			20	0
Coal, splinty	0′	5″		
Bone	0	7		
Coal, splinty	1	9		
Bone	0	0½		
Coal, gas	0	5		
Shale, gray, dark	0	6		
Coal, splinty	0	3		
Coal, semi-splint, slightly bony	1	2	5	1½
Shale, sandy			1	0
Sandstone to railroad grade			4	0

Coal Opening—No. 851 on Map II.

On west bank of Elk River, ½ mile N. 15° W. of mouth of Leatherwood Creek; **Coalburg Coal**; elevation, 730′ B.; examined by the writer.

			Ft.	In.
Sandstone, greenish-gray, coarse, visible			2	0
Coal, splinty	0′	4″		
Bone, black	0	7		
Coal, semi-splint	2	0		
Shale, dark-gray	0	8		
Coal, splinty (slate floor)	1	7	5	2

Maggie Saulsbury Coal Opening—No. 852 on Map II.

At mouth of Lick Branch, 0.85 mile N. 5° W. of mouth of Leatherwood Creek; **Coalburg Coal**; elevation, 702′ L.; examined by Gawthrop.

				Ft.	In.
Concealed from bench				15	0
Coal blossom in road, Clarion, visible				0	3
Shale and concealed				25	0
Sandstone, massive, gray, hard, **Homewood**				15	0
Concealed				30	0
Shale, **Kanawha Black Flint horizon**				5	0
Coal, Stockton				1	6
Concealed				3	0
Sandstone, massive				40	0
Coal	0′	3″			
Slate	0	9			
Coal, splinty	2	0	**Coalburg**	3	0
Shale				1	0
Concealed to bed of Lick Branch				6	0

Hansford Reed Heirs Coal Opening—No. 853 on Map II.

On north side of Elk River, ¼ mile northeast of mouth of Middle Creek; **Coalburg Coal**; elevation, 750′ B.; examined by Gawthrop.

			Ft.	In.
Sandstone, massive, visible			6	0
Coal, splint	0′	5″		
Slate	0	1		
Coal, semi-splint	1	7		
Slate	0	11		
Coal, splint, visible	1	0	4	0

Vener Townsend Coal Opening—No. 854 on Map II.

On north side of Elk River, 0.6 mile north of Elkhurst; **Coalburg Coal**; elevation, 790′ B.

			Ft.	In.
Coal, visible, **Stockton**			0	8
Shale, siliceous			6	0
Coal	0′	3″		
Shale, black	0	7		
Coal, semi-splint	2	0		
Slate	0	3		
Coal, splint (slate floor)	2	0	5	1

Harrison Pierson Coal Opening—No. 855 on Map II.

On north bank of Elk River, 0.3 mile N. 45° W. of Elkhurst; **Coalburg Coal**; elevation, 775′ B.

				Ft.	In.
Shale, siliceous, visible				5	0
Slate, **Kanawha Black Flint**				4	0
Coal	1′	4″			
Slate	0	3			
Coal, bony	0	8	**Stockton**	2	3
Fire clay shale				4	0
Coal				0	4
Shale, dark, siliceous				5	0
Slate				1	0
Coal	0′	3″			
Slate, dark	0	6			
Coal, splint	2	1			
Slate, black	0	6			
Coal, splint, visible	2	0	**Coalburg**	5	4
Concealed by water					

The interval separating the Stockton and Coalburg beds at the two above openings—Nos. 854 and 855—is in marked

Photo by McClellan Leonard.

PLATE XXVII.—Showing sample of natural coke made by forest fire from Coalburg Coal at Opening No. 873 on Map II. (See description of opening, page 734).

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contrast to that at Clay, but corresponds the south side of Elk near Dorfee (See D 146).

In the southwest border of the same the 8 following openings on the waters of were examined by the writer:

The details at **Coal Opening No. 856 o** bank, 0.3 mile up Cove Hollow of Leather **burg Coal**; elevation, 810′ B.; are given in 142, with the Section for Morocco.

Coal Prospect—No. 857 on M

In south bank of Devils Den Branch, 0.6 mile Creek; **Coalburg Coal**; elevation, 860′ B.; section

Coal (slate roof)	0′	6″
Bone	0	5
Coal	1	7
Slate	0	7
Coal, splint (slate floor)	1	10

The details at **Coal Opening No. 858 or** bank of branch of Leatherwood Creek, 0.4 mouth of Right Fork; **Coalburg Coal**; eleva published on page 701, with section give No. 784 of Stockton Coal.

Coal Opening—No. 859 on Ma

On east bank of branch of Leatherwood Cree E. of mouth of Right Fork; **Coalburg Coal**; elevatio

Shale, sandy, visible		
Sandstone		
Shale, sandy		
Coal, bony	0′	2″
Slate	0	5
Coal, splint	0	9
Shale	0	5
Coal, bony	0	3
Coal, gray splint, hard (slate floor)	2	0

The above opening is 50 to 60 feet belo Black Flint at Coal Exposure No. 785 in St opposite on west hillside (See page 702).

Coal Opening—No. 860 on Map II.

On west hillside of Leatherwood Creek, 1.1 miles southeast of mouth of Right Fork; **Coalburg Coal**; elevation, 965′ B.

			Ft.	In.
Sandstone, visible			1	3
Coal, splinty and bony	1′	6″		
Shale, dark-gray	0	3		
Coal and slate	0	5		
Coal, splint, visible	0	6	2	8
Concealed by mud and water				

Elliott Splint Coal Co. Opening—No. 861 on Map II.

On east hillside of Leatherwood Creek, 1 mile northwest of mouth of Road Fork; **Coalburg Coal**; elevation, 1100′ B.

			Ft.	In.
Coal, splint (shale roof)	1′	5″		
Shale, gray	0	3		
Coal, splint	0	3		
Shale, gray	0	6		
Coal, splint, hard (slate floor)	1	6	3	11

The above opening is about 45 feet directly below the **Kanawha Black Flint** at Opening No. 786 in Stockton Coal (See page 702).

William Morris Coal Opening—No. 862 on Map II.

On east hillside of Leatherwood Creek, 0.9 mile northwest of mouth of Road Fork; **Coalburg Coal**; elevation, 1100′ B.

			Ft.	In.
Shale, sandy, visible			7	0
Coal, semi-splint	2′	0″		
Shale, dark-gray	0	8		
Bone	0	8		
Coal, splint	1	6		
Shale, black, argillaceous	0	4		
Coal, splint, hard (slate floor)	1	9	6	11

Coal Opening—No. 863 on Map II.

On east hillside of Leatherwood Creek, 0.5 mile northwest of mouth of Road Fork; **Coalburg Coal**; elevation, 1190′ B.; prospect closed; thickness reported 4 to 5 feet.

Pleasant District, Clay County.

In Pleasant District, the Coalburg Coal appears to attain a more regular development than in Henry, its thickness and stratigraphic position here being exhibited in the sections published in Chapter IV for Schoonover Knob, Dorfee, Morocco—2 Miles South, Head of Sycamore Creek, Lick Branch of Adonijah. and Greendale; in the detailed logs of Coal Test Borings Nos. 45B and 45C on Map II, and in the record of the Elk River Lumber Co. No. 2 Well—No. 131 on Map II, pages 478, 479, and 374, respectively. The seven following openings along the south hillside of Elk River are in the northern edge of the District:

Samuel Stephenson Coal Opening—No. 864 on Map II.

On point just southeast of Hartland and mouth of Middle Creek; **Coalburg Coal**; elevation, 785′ B.; examined by Gawthrop.

				Ft.	In.
Coal, gas (shale roof)	2′	6″			
Shale, gray	0	7			
Coal, splinty	0	11	**Coalburg**...	4	0
Shale and concealed with sandstone to bench for **Winifrede Coal**				65	0

The above opening is now (January, 1917) being operated by the Hartland Colliery Company to furnish domestic fuel for the new town of Hartland at the mouth of Middle Creek.

The details at **Thompson Land & Coal Co. Opening—No. 865 on Map II,** on south hillside of Elk River; **Coalburg Coal**; elevation, 850′ B.; are published in Chapter IV with the Schoonover Knob Section, page 145.

C. E. Lewis Coal Opening—No. 866 on Map II.

On southwest hillside of Elk River, opposite mouth of Blue Knob Creek; **Coalburg Coal**; elevation, 820′ B.; examined by Gawthrop.

				Ft.	In.
Coal, gas (shale roof)	0′	11″			
Bone	0	3			
Coal, semi-splint	1	2			
Shale, gray, hard	1	2			
Coal, splint (slate floor)	2	0	......	5	6

The details at **Coal Opening No. 867 on Map II**, on west hillside of Elk River, 0.6 mile northeast of Dorfee; **Coalburg Coal**; elevation, 775′ B.; examined by Gawthrop and the writer, are published in Chapter IV, page 146, with the Dorfee Section. Gawthrop first found the **Kanawha Black Flint** exposure above this opening which was later visited by the writer and the correlation of the latter member verified. In the section last mentioned, the bed correlated as the Coalburg is absolutely the same as that formerly operated by the Dorfee Coal Mining Company at the following mine, also examined during 1915 by the writer:

Dorfee Coal Mining Co. Mine—No. 868 on Map II.

On east hillside of Elk River at Dorfee; **Coalburg Coal**; elevation, 805′ B.

			Ft.	In.
Shale, buff, sandy, visible			4	0
Shale, dark, argillaceous			1	6
Coal, splint	1′	9″		
Bone, black	0	4		
Coal, splint	2	0		
Shale, gray, argillaceous	1	2		
Coal, slaty	0	4	5	7
Shale, gray, argillaceous, visible			3	0

The writer also measured a section of the coal in this mine several years ago and the results were published by I. C. White in Volume II(A), page 441, as follows:

			Ft.	In.
1. Shale				
2. **Coal**	2′	0″		
3. "Niggerhead," "dead" **coal**	0	2		
4. Slate, sandy	0	4		
5 **Coal**	2	1	4	7
6. Fire clay			2	1½

"Butts, N. 9° W.; faces, N. 81° E.; greatest rise, northwest. Sample from Nos. 2 and 5, collected by Henry Brooke, General Manager of the Dorfee Company, for analysis of which see **No. 868*** in the table of coal analyses at the end of this Chapter.

"Mr. Brooke also sent a sample of the 'dead' coal, or 'niggerhead,' No. 3 of the section, which gave the following results in the Survey Laboratory:

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*No. 25 on page 466 of Volume II(A).

	Per cent.
Moisture	2.50
Volatile Matter	19.65
Fixed Carbon	27.85
Ash	50.00
Total	100.00
Sulphur	0.43
Phosphorus	0.009

"Mr. Brooke reports the following as the analysis of the Dorfee Coal, made by the chemist of the Columbia Iron Company:

	Per cent.
Moisture	1.009
Volatile Matter	40.631
Fixed Carbon	56.030
Sulphur	0.700
Ash	11.630
Total	100.000"

When visited by the writer in the latter part of October, 1915, the above mine had been shut down for a year on account of financial difficulties, being in the hands of a receiver, but is reported to have been sold to the Thompson Land & Coal Company just previous to the date mentioned.

Coal Opening—No. 869 on Map II.

On southwest hillside of Elk River, 0.4 mile northwest of Eldorado; **Coalburg Coal**; elevation, 785' B.; examined by Gawthrop.

		Ft.	In.
Sandstone, massive, visible		20	0
Coal, splinty	1' 11"		
Coal, bony	0 7	2	6
Shale, visible		5	0

Coal Opening—No. 870 on Map II.

On south hillside of Elk River, 0.4 mile northeast of Shelton, in edge of road; **Coalburg Coal**; elevation, 750' B.; examined by Gawthrop; prospect closed; thickness not known.

The six following openings in the Coalburg Coal in the same District (Pleasant) are all on the waters of Middle Creek:

The details at **Coal Opening No. 871 on Map II,** on an east branch of Middle Creek, 1.3 miles south from Elk River;

Coalburg Coal; elevation, 880′ B., are given with the Section at **Coal Opening No. 793** in the Stockton Coal, page 707, on the authority of M. McD. Price.

Coal Opening No. 872 on Map II, on west hillside of Middle Creek, 1.8 miles south of Hartland; **Coalburg Coal**; elevation, 895′ B.; examined by the writer, was closed, formerly used to supply Lumber Company, and coal reported about 4 feet thick.

Hartland Colliery Co. Coal Opening—No. 873 on Map II.

On south bank, 0.45 mile up Cottrill Fork of Middle Creek, 0.7 mile southwest of No. 872; **Coalburg Coal**; elevation, 915′ B.; examined by the writer.

			Ft.	In.
Shale, sandy			10	0
Coal, slaty			0	8
Shale, dark, with iron ore nodules			6	0
Coal, splint	1′	6″		
Fire clay, dark, hard	0	3		
Bone	0	5		
Coal	0	2		
Bone	0	3		
Coal, slaty	0	2		
Coal, splint (slate floor)	2	4	5	1

The above opening is 35 feet below the Kanawha Black Flint at Prospect No. 792 on Map II in the Stockton bed. The composition of samples of coal and coke from the top and bottom benches at Prospect No. 873 above, collected by McClellan Leonard and determined by the French-Pancoast Laboratories of New York City, is reported as follows by M. McD. Price:

	Coal Per cent.	"Natural Coke." Per cent.
Moisture	1.10	0.56
Volatile Matter	38.33	......
Fixed Carbon	53.47	91.81
Ash	7.10	7.63
Totals	100.00	100.00
Sulphur	0.77	0.56
Phosphorus	.....	None

"The sample of coke, as examined in section sheet, was taken from the outcrop of the 'Lower Carver' (Coalburg*) seam where the coal had been coked, evidently by forest fires."

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*Final correlation as determined by author of this Report.

Samuel Stephenson Coal Openin

On west bank, 0.2 mile up Lick Br
burg Coal; elevation, 960' B.; examined

Coal, splint, (shale roof), 4" to	0'
Shale, dark-gray	0
Coal, splint	1
Shale, dark-gray	0
Coal, bony	0
Coal, gray splint, hard (slate pavement)	2

A sample for analysis was collec
by C. E. Krebs, formerly Assistant G
vey staff, and forwarded to Messrs. I
sis, the results of which, as kindly
are published under **No. 874** in the
end of this Chapter.

Samuel Stephenson Coal Opening-

On east bank of Middle Creek, 0.4 mile
burg Coal; elevation, 970' B.; examined by

Shale, sandy, dark, visible	
Coal, splinty	0'
Bone	0
Coal, bony	0
Bone	0
Coal, bony splint	0
Fire clay, dark	0
Coal, slaty	0
Coal, gray splint (slate floor)	2

Coal Exposure—No. 876 on Map
Creek, passing below drainage ½ m
Branch, 30 feet below Kanawha Black
elevation, 980' B.; examined by the w

The three following openings i
(Pleasant), examined by the writer, a
Leatherwood Creek:

Samuel Stephenson Coal Opening—No. 877 on Map II.

On south side of hill road, ¾ mile up Right Fork of Leatherwood Creek; **Coalburg Coal**; elevation, 970′ B.

			Ft.	In.
Sandstone, visible			15	0
Coal, splint	0′	5″		
Shale, gray	0	5		
Coal, splint	1	2		
Shale, dark-gray, hard	0	3½		
Coal, splint	0	10		
Shale, dark-gray, sandy	0	4		
Coal, gray splint, hard (slate floor)	1	7	5	0½

The details at the **Hartland Colliery Company Coal Opening—No. 878 on Map II,** on a west branch of Right Fork, 0.3 mile north of No. 877; **Coalburg Coal;** elevation, 951′ L., are published in section with **Opening No. 788** in Stockton Coal (See page 704).

The composition of a sample collected at the above opening by McClellan Leonard and determined by the French-Pancoast Laboratories, New York City, as reported by M. McD. Price, is as follows:

	As Received. Per cent.	Dry Basis. Per cent.
Moisture	1.20	0.00
Volatile Matter	35.74	36.17
Fixed Carbon	53.94	54.60
Ash	9.12	9.23
Totals	100.00	100.00
Sulphur	0.85	0.86

The details at **Coal Opening No. 879 on Map II,** in a west branch of Leatherwood Creek, ½ mile N. 75° W. of mouth of Right Fork; **Coalburg Coal;** elevation, 895′ B., are published with the section of **Opening No. 787** in the Stockton Coal.

The 17 following openings in the Coalburg bed, on the waters of Sycamore Creek in the same District (Pleasant), were all examined by the writer:

Clay Lumber Co. Coal Opening—No. 879A on Map II.

On west hillside of Sycamore Creek, 0.15 mile northwest of Adonijah Fork; **Coalburg Coal**; elevation, 915′ B.; opening closed; 3 to 4 feet of coal reported.

L. L. Cottrill Coal Opening—No. 880 on Map II.

On north side of Sycamore Creek, 0.4 mile due east of Adonijah Fork; **Coalburg Coal**; elevation, 905′ B.

			Ft.	In.
Sandstone, current-bedded, **Upper Coalburg**, visible			20	0
Coal, splinty	0′	9″		
Shale, dark-gray	0	4		
Coal, splint	0	5		
Bone	0	4		
Coal, splinty	1	3		
Fire clay shale, hard	0	5		
Coal, splint	0	2		
Fire clay, black, hard	0	3		
Coal, slaty	0	7		
Coal, gray splint, hard	2	0		
Coal, splint, hard (slate floor)	0	4	6	10

L. L. Cottrill Coal Opening—No. 881 on Map II.

On west bank of Sycamore Creek, 0.4 mile southeast of Adonijah Fork; **Coalburg Coal**; elevation, 900′ B.

			Ft.	In.
Sandstone, **Upper Coalburg**			20	0
Coal, splint	0′	7″		
Bone	0	1		
Coal, splint	0	9		
Shale, dark-gray	0	2		
Coal, splint	0	2		
Shale, dark-gray	0	4		
Coal, splint, visible	1	0	3	1
Concealed by water				

John Rogers Coal Opening—No. 882 on Map II.

On west bank, 0.1 mile up Right Fork of Sycamore Creek; **Coalburg Coal**; elevation, 890′ B.

			Ft.	In.
Sandstone, visible, **Upper Coalburg**			25	0
Coal, slaty, 0″ to	0′	2″		
Shale, dark-gray	0	6		
Coal, slaty	0	8		
Coal, splint	0	11		
Bone	0	3		
Coal, splint	1	6		
Shale, dark-gray, argillaceous	0	4		
Coal, splinty	0	4		
Shale, dark	0	3		
Coal, slaty	0	5		
Coal, splint, gray (slate floor)	2	11	8	

Samuel Stephenson Coal Opening—No. 883 on Map II.

On east bank of Right Fork, 0.7 mile south of No. 882; **Coalburg Coal**; elevation, 910′ B.

			Ft.	In.
Sandstone, Upper Coalburg			40	0
Coal, splint	0′	8″		
Coal, gray splint, hard	0	4		
Coal, splint, hard (slate floor)	2	4	3	4

Coal Opening—No. 884 on Map II.

On north bank, 0.2 mile up Grassy Fork, 1.2 miles N. 30° E. of Lizemores; **Coalburg Coal**; elevation, 940′ B.; closed, 15 to 18 inches of coal visible at base of sandstone cliff.

Serena Brown Coal Opening—No. 885 on Map II.

On north bank of Sycamore Creek, 0.6 mile southeast of mouth of Right Fork; **Coalburg Coal**; elevation, 905′ B.

			Ft.	In.
1. Sandstone, visible, greenish-gray, medium-grained, **Upper Coalburg**			20	0
2. **Coal**, splint	0′	9″		
3. Slate, with **coal** streak	0	9		
4. **Coal**, bony	0	3		
5. Slate, black, **coaly**	0	7		
6. **Coal**, bony	0	7		
7. **Coal**, gray splint, hard	2	8	5	7
8. Slate floor				

The analysis of a sample (900H) collected by the writer from No. 7 only of above section, as reported by Messrs. Hite and Krak, is given under **No. 885** in the table of coal analyses at the end of this Chapter.

Serena Brown Coal Opening—No. 886 on Map II.

On north bank of Sycamore Creek, 0.15 mile southeast of No. 885; **Coalburg Coal**; elevation, 930′ B.

			Ft.	In.
Sandstone, visible, **Upper Coalburg**			20	0
Coal, splint	0′	10″		
Bone	0	2		
Coal, splint	0	5		
late, **coaly**	0	2		
l, splint	0	4		
. black, **coaly**	0	4		

jah
feet of

			Ft.	In.
Coal, slaty	0′	7″		
Coal, gray splint, hard	2	6	5	4
Slate and concealed			5	0
Sandstone, massive, makes cliff, **Lower Coalburg**, to bed of Sycamore Creek			30	0

Hartland Colliery Co. Coal Opening—No. 887 on Map II.

On east bank of a south branch of Sycamore Creek, 0.4 mile due west of Big Hollow; **Coalburg Coal**; elevation, 960′ B.; opening partially closed; 3 to 4 feet of coal visible.

Hartland Colliery Co. Coal Opening—No. 888 on Map II.

On west hillside, 0.2 mile up Big Hollow of Sycamore Creek; **Coalburg Coal**; elevation, 995′ B.

			Ft.	In.
Sandstone, visible			20	0
Coal, bony	0′	2″		
Shale, black, 6″ to	1	3		
Coal, splint, bony	0	2		
Shale, gray	0	2		
Coal, splint, bony	1	0		
Bone	0	2		
Coal, splint, bony	1	9		
Shale, dark, coaly	1	2		
Coal, gray splint, hard	2	7	8	5
Slate floor				

Hartland Colliery Co. Coal Opening—No. 889 on Map II.

On east hillside, 0.2 mile up Laurel Fork of Sycamore Creek; **Coalburg Coal**; elevation, 1050′ B.

			Ft.	In.
Sandstone, visible, **Upper Coalburg**			15	0
Coal, splinty, slightly bony	1′	10″		
Shale, dark-gray, argillaceous	0	10		
Coal, slaty	0	10		
Coal, splint, hard (slate floor)	2	2	5	8

Reuben Neil Coal Opening—No. 890 on Map II.

On north bank of Sycamore Creek ¼ mile east of mouth of Laurel Fork; **Coalburg Coal**; elevation, 1045′ B.

			Ft.	In.
Sandstone, visible, **Upper Coalburg**			20	0
Coal, splint	2′	4″		
Bone	0	1		
Coal, splint	0	4	2	9
Coal, pavement, thickness concealed				

L. T. Jones Coal Opening—No. 891 on Map II.

On north bank of Sycamore Creek, 0.4 mile east of mouth of Laurel Fork; **Coalburg Coal**; elevation, 1030′ B.

			Ft.	In.
Sandstone, visible, **Upper Coalburg**			25	0
Coal, splint	0′	2″		
Bone	0	2		
Coal, splint	1	7		
Fire clay shale, black	0	3		
Coal, splint	0	2		
Fire clay shale, black	0	10		
Coal and slate interlaminated	0	6		
Coal, gray splint, hard	2	5		
Fire clay shale, dark	0	4		
Coal, splint, visible	0	5	6	10

A sample for analysis was collected at the above opening by C. E. Krebs, formerly on the State Survey staff, and forwarded to Messrs. Hite and Krak for analysis, the results of which, as kindly furnished by Mr. Krebs, are published under **No. 891** in the table of coal analyses at the end of this Chapter.

J. M. Moore Coal Opening—No. 892 on Map II.

On west bank of Sycamore Creek, 0.4 mile northwest of mouth of Payne Branch; **Coalburg Coal**; elevation, 1085′ B.

			Ft.	In.
Sandstone, visible, **Upper Coalburg**			25	0
Coal, splint, slightly bony	0′	10″		
Coal, splint (slate floor)	2	0	2	10

The details at **Hartland Colliery Company Coal Opening —No. 893 on Map II,** on east bank of Sycamore Creek, 0.3 mile southeast of Payne Branch; **Coalburg Coal;** elevation, 1140′ B.; are published with the Head of Sycamore Creek Section, Chapter IV, page 148.

Hartland Colliery Co. Coal Opening—No. 894 on Map II.

On east bank of Sycamore Creek, 0.6 mile southeast of Payne Branch; **Coalburg Coal**; elevation, 1185′ B.

			Ft.	In.
Shale, dark, argillaceous, sandstone on top, 0″ to			0	4
Coal, splinty	3′	0″		
Shale, gray, dark, 1″ to	0	2		
Coal, bony	0	2		

		Ft.	In.
Coal, dark-gray, argillaceous	1' 2"		
Coal, gray splint, hard	1 5	5	11
Shale, gray, floor			

Coal Opening—No. 895 on Map II.

On west bank of Sycamore Creek, 0.7 mile southeast of Payne Branch; **Coalburg Coal**; elevation, 1190' B.

		Ft.	In.
Sandstone, visible, **Upper Coalburg**		10	0
Coal, splint	2' 5"		
Shale, gray, dark	0 3		
Coal	0 2		
Shale, gray	1 2		
Coal, slaty	0 2		
Coal, gray splint, hard (slate pavement)	1 5	5	7

Coal Opening No. 896 on Map II, on west bank of Rockcamp Fork, 1.4 miles N. 40° E. of Greendale; **Coalburg Coal**; elevation, 1160' B.; examined by the writer, was closed, but coal is probably present in normal development for region.

Coal Exposure No. 897 on Map II, in road, 0.4 mile N. 30° W. of Greendale; **Coalburg Coal**; elevation, 1090' B.; examined by the writer, shows 4 to 5 feet of weathered coal.

Coal Opening—No. 898 on Map II.

On west hillside of Rockcamp Fork, at Greendale; No. 2 Entry of Mine No. 899; **Coalburg Coal**; elevation, 1140' B.; section taken on rib, 50 to 100 feet in No. 2 Entry, by writer in 1915.

		Ft.	In.
Shale, bluish-gray, sandy, visible		2	0
Slate and **coal**, interlaminated, mostly slate, 6" to	0' 10"		
Coal, splint, hard, 3' to	3 2	4	0
Shale, gray, argillaceous		2	0

Several years ago the writer collected a sample for analysis and obtained the following section and data as published by I. C. White on pages 461-2 of Volume II(A) of the State Survey Reports, at which time it was known as the **"Raven Mine"** of the Paint Creek Colliery Company:

Ridgewood Coal Co. "Raven" Mine—No. 899 on Map II.

On west hillside of Rockcamp Fork, 0.2 mile southwest of Greendale; Coalburg Coal; elevation, 1165′ B.

				Ft.	In.
1.	Draw slate				
2.	Slate, streaks of coal	0′	4″		
3.	Coal, hard splint	1	9		
4.	Bone coal	0	1		
5.	Coal, gas, 4″ to	0	6		
6.	Coal, splint (slate floor)	1	0	3	8

The composition of the sample, from Nos. 3, 5, and 6 of the above section, as taken from No. 21 in the table opposite page 284 in Bulletin No. 2 of the State Survey Reports, is republished under **No. 899** in the table of coal analyses at the end of this Chapter.

Westward in the same District (Pleasant), the writer examined the two following openings on the waters of Open Fork:

Coal Opening—No. 900 on Map II.

On south bank of Sangamore Fork, 1.0 mile northeast of Scotford; Coalburg Coal; elevation, 1105′ B.

			Ft.	In.
Coal and slate mixed, visible	0′	9″		
Coal, splinty	3	11	4	8
Shale, gray, to bed of Sangamore Fork			15	0

Coal Opening—No. 901 on Map II.

On west bank of Open Fork, 0.9 mile N. 15° W. of Scotford; Coalburg Coal; elevation, 1015′ B.

			Ft.	In.
Sandstone, shaly, visible			2	0
Shale, with coal streaks and iron ore nodules			1	6
Shale, gray, argillaceous			0	6
Coal, gas	0′	4″		
Bone	0	2		
Coal, gas	0	5		
Bone	0	2		
Coal, slaty	0	3		
Coal, semi-splint	2	0		
Coal, splint (slate floor)	1	6	4	10

The two following commercial mines on the Coalburg Coal in the edge of Nicholas County were examined by Gawthrop, but the sections given were obtained by the writer several years ago along with samples being republished from pages 458-9 of Volume II(A) of the State Survey Reports. That at No. 902 is very important, in that the position of the Kanawha Black Flint, Stockton, and Coalburg Coals is shown:

Coalbell Coal Co., Carter Mine—No. 902 on Map II.

On east hillside of Open Fork, 0.2 mile northeast of Carterboro; **Coalburg Coal**; elevation, 1160' B.

					Ft.	In.
1.	**Kanawha Black Flint**, typical				6	0
2.	Slate, black, and concealed				4	0
3.	**Coal, Stockton**, splint, clean				3	0
4.	Concealed				80	0
5.	Shale, with streaks of coal, 8" to	1'	0 "			
6.	**Coal**, splint	1	7½			
7.	Bone	0	0½			
8.	**Coal**, gas	0	8			
9.	**Coal**, splint	1	4			
10.	Fire clay, soft, gray	0	8			
11.	**Coal**, gas, hard	0	10	**Coalburg**	6	2

Butts, N. 80° W.; faces, N. 10° E.

The composition of the sample collected by the writer from Nos. 6, 7, 8, 9, and 11 of the above section, as given under No. 16 in the table facing page 284 of Bulletin 2 of the State Survey Reports, is republished in the table of coal analyses at the end of this Chapter under **No. 902.** At the time this mine was sampled, it was operated by the Carter Coal Company.

Coalbell Coal Co., "Scott" Mine—No. 903 on Map II.

On west hillside of Open Fork, 0.2 mile southwest of Carterboro; **Coalburg Coal**; elevation, 1150' B.

				Ft.	In.
1.	Sandstone, massive, visible			20	0
2.	Shale			4	0
3.	Slate			1	6
4.	**Coal**, hard splint	2'	7"		
5.	Slate, soft, gray	0	1		
6.	**Coal**, gas, hard	0	5		
7.	Bone	0	1		
8.	**Coal**, splint (slate floor)	1	11	5	1

The composition of a sample collected by the writer from Nos. 4, 6, and 8 of the above section, as given under No. 15 in the table facing page 284 of Bulletin 2 of the State Survey Reports, is republished under **No. 903** in the table of coal analyses at the end of this Chapter. At the time this mine was sampled it was then owned by the Gauley Consolidated Coal Company.

In the southern point of Pleasant District, the two following openings were examined by Gawthrop:

Coal Opening—No. 904 on Map II.

In branch on west side of Rockcamp Fork, 2.3 miles due west of Scotford; **Coalburg Coal**; elevation, 965′ B.

			Ft.	In.
Sandstone, massive			30	0
Concealed			5	0
Coal, visible			0	6
Shale			3	0
Slate, with coal streaks	2′	0″		
Coal, splint	1	11		
Shale	0	5		
Coal, slaty	0	5		
Shale, dark	0	6		
Coal, splint (shale floor)	0	10	6	1

Abe Franks Coal Opening—No. 905 on Map II.

On west bank of Rockcamp Fork, 1.3 miles north of common corner of Clay, Nicholas, Fayette, and Kanawha Counties; **Coalburg Coal**; elevation, 965′ B.

				Ft.	In
Sandstone, shaly, visible				5	0
Slate, black				2	0
Coal, cannel				0	6
Shale, gray				4	0
Slate, dark, coal streaks	2′	0″			
Coal, slaty	0	6			
Coal, splint	2	3	Coalburg	4	9
Concealed to bed of Rockcamp Fork				3	0

Union District, Clay County

In Union District, the thickness and stratigraphic position of the Coalburg Coal are exhibited in the sections given in Chapter IV for Procious, Marne—0.7 Mile West, Birch, and

Bomont—1 Mile East; and in the Chapter IX for the borings sunk fo table below:

List of Wells Showing Thickne

No. on Map II.	Thickness Feet	No. on Map II.	T
144	4	160	
147	5	163	
148	2	164	
149	2	165	
150	2	167	
151A	3	169	1
152	5	170	
153	8	179	
155	4	180	
156	5	181	
158	10	183	

The 3 following openings on the more Creek are all in the eastern bord

Coal Opening—No. 906 c

On west hillside of Little Sycamore Cr Open Hollow; **Coalburg Coal**; elevation, 830

Sandstone, massive, **Upper Coalburg**....
Shale ....
Coal, hard, splinty (shale floor).........

Brown Coal Opening—No. 90

On west hillside of Little Sycamore Cre Open Hollow; **Coalburg Coal**; elevation, 805 throp.

Shale, dark, siliceous		
Slate, black		
Coal, gas	1'	6'
Coal, splint	1	0
Slate, black	2	0
Fire clay shale	4	0
Coal, weathered	2	0
Shale		
Sandstone to bed of Little Sycamore Creel		

Coal Opening No. 908 on Map II, edge of road on Wade Fork, 0.4 mile southwest of Shelton; **Coalburg Coal;** elevation, 740′ B.; was closed, but belongs about 40 feet below the Kanawha Black Flint at Coal Exposure No. 800 of the Stockton bed, described on page 709.

The details at **Coal Opening No. 909 on Map II,** on north bank of Upper Birch Run, 100 yards west of Birch Station; **Coalburg Coal;** elevation, 670′ B., are given with the section in Chapter IV, pages 159-160, for Birch. The 15 inches of black siliceous slate immediately above the lower bench at the latter opening strongly resembles one of the 3 or 4 phases assumed by the Kanawha Black Flint, but no marine fossils were found in it, and the stratigraphic evidence as a whole is more in favor of its being a member of the Coalburg bed-section.

The 3 following openings in the same District (Union) are along Elk River and Laurel Creek:

Coal Opening—No. 910 on Map II.

On northwest bank of Elk River, 0.4 mile N. 15° E. of Birch; Coalburg Coal; elevation, 680′ B.

			Ft.	In.
Sandstone, massive, making cliff, Upper Coalburg			30	0
Fire clay shale			1	2
Coal, semi-splint	1′	5″		
Shale	1	5		
Coal, gray splint, hard	1	8	4	6
Fire clay			1	0
Sandstone to Coal & Coke Ry. grade			2	0

Coal Opening—No. 911 on Map II.

On point, west bank of Elk River, 0.6 mile N. 45° E. of Birch; Coalburg Coal; elevation, 705′ B.

			Ft.	In.
Coal blossom, visible, Stockton?			..	..
Fire clay shale			3	0
Sandstone			2	6
Shale, gray, argillaceous			1	6
Coal, semi-splint	0′	3″		
Shale, dark	0	1		
Coal, semi-splint	1	10		
Shale, dark-gray	0	4		
Coal, gray splint, hard	2	0 Coalburg	4	6
Shale, gray, and concealed to Coal & Coke Ry. grade			30	0

Coal Opening—No. 912 on Map II.

On south bank of Laurel Creek, ¼ mile east of Rouzer Station; **Coalburg Coal**; elevation, 635′ B.; also examined by Gawthrop.

			Ft.	In.
Coal, bony (sandstone roof)	0′	0½″		
Shale, gray, sandy	1	3		
Coal, bony	0	4		
Shale, gray, soft	1	0		
Coal, splint, hard	1	0		
Coal, gas, medium-soft	0	3		
Bone, hard	0	6		
Coal, splint, hard (slate floor)	1	8	6	0½

The above opening belongs 35 to 40 feet below the outcrop of the Kanawha Black Flint, the latter carrying **Orbiculoidea capuliformis** fossils and having a phase between shale and chert.

Farther up Laurel Creek in the same District, the 2 following openings were examined by Gawthrop:

Coal Opening—No. 913 on Map II

On north bank of Laurel Creek, 0.7 mile southeast of Rouzer Station; **Coalburg Coal**; elevation, 660′ B.

			Ft.	In.
Sandstone, massive, **Upper Coalburg**			15	0
Coal	0′	3″		
Fire clay shale, gray	1	6		
Coal, splint	1	8		
Slate, black, bony	0	3		
Coal, splint	1	0	4	8
Coal, concealed by water				

Coal Opening—No. 914 on Map II.

In mouth of Twomile Branch of Laurel Creek; **Coalburg Coal**: elevation, 670′ B.

			Ft.	In.
Sandstone, massive, brown, **Upper Coalburg**			15	0
Coal	0′	3″		
Slate	0	8		
Coal, visible	0	6	1	5
Coal, concealed by water				

The details at the **Samuel Samples Coal Opening—No. 915 on Map II**, on east bank of Dulls Creek, 0.2 mile northeast of Procious; **Coalburg Coal**; elevation, 690′ B.; are published with the section in Chapter IV, pages 156-7, for Procious.

The following opening in the southern end of Union District, according to Gawthrop, belongs about 300 feet below the Upper Kittanning Coal and 75 feet below the bench for the Stockton bed, thus approaching conditions prevailing in the Greendale region as regards the Stockton—Coalburg interval:

N. W. Pritt Coal Opening—No. 916 on Map II.

On west bank of Blue Creek, at mouth of Tent Branch; **Coalburg Coal**; elevation, 950′ B.

			Ft.	In.
Sandstone, massive, **Upper Coalburg**			10	0
Fire clay shale, 0″ to			1	0
Coal, semi-splint	0′	11″		
Fire clay shale	1	8		
Slate, **coaly**	0	10		
Coal, gas	1	6		
Shale	1	0		
Coal, hard, gas (shale floor)	0	10	6	9

Quantity of Coalburg Coal Available.

Based on the data given on preceding pages and a planimetric determination by Tucker from Map II as the minable area of the bed is limited on Figure 13, page 713, the following estimate is made for the amount of Coalburg Coal available in the territory of this Report:

Probable Amount of Coalburg Coal.

Clay County by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Buffalo	2.0	26.65	17,056	1,485,918,720	59,436,749
Henry	3.0	64.70	41,408	5,411,197,440	216,447,897
Pleasant	3.0	57.30	36,672	4,792,296,960	191,691,878
Union	2.5	49.45	31,648	3,446,467,200	137,858,688
Total		198.10	126,784	15,135,880,320	605,435,212

As with estimates made for other coals on preceding pages, the thickness of bed assumed in the above table in each District is less than half that found at many prospect openings, thus averaging up the doubtful regions in the area designated as minable on Figure 13.

WINIFREDE COAL.

In the territory of this Report, the Winifrede Coal, described briefly in Chapter VIII, pages 260-261, in minable dimensions and regularity, appears to be confined to a region 2 to 6 miles wide in the southeast border of Clay County, as shown on Figure 14 below. It has been correlated in this locality with a bed belonging 60 to 75 feet below the undoubted Coalburg Coal, and has never been mined commercially, although prospected considerably by natives for local domestic fuel in the latter County. Its approximate elevation at any point may be readily determined by a liberal use of the tables of intervals in Chapter III, pages 26-28, in conjunction with the structure contours on Map II. Its thickness and character at crop exposures, openings, and in borings will now be described by magisterial districts.

Holly District, Braxton County.

In Holly District, the Winifrede Coal does not appear to attain minable dimensions and persistence, but its stratigraphic position is indicated in the section given in Chapter IV, page 98, for Holly—1.3 Miles Southwest, where it is shown as representing a double-bedded seam directly above the undoubted marine fossiliferous Winifrede Limestone. The data at the two following exposures were obtained by the writer:

Coal Exposure—No. 917 on Map II, in excavation for B. & O. R. R. bridge abutment, north bank of Elk River, at Holly Junction; **Winifrede Coal**; elevation, 873′ L.; coal reported 2 feet thick by G. D. Gillespie, this being no doubt the same bed referred to by I. C. White in the basal member of the section published on page 522 of Volume II(A) of the State

Survey Reports. It belongs about 50 feet below the Coalburg at **Exposure No. 809** and 85 feet below the Stockton at **Opening No. 756.**

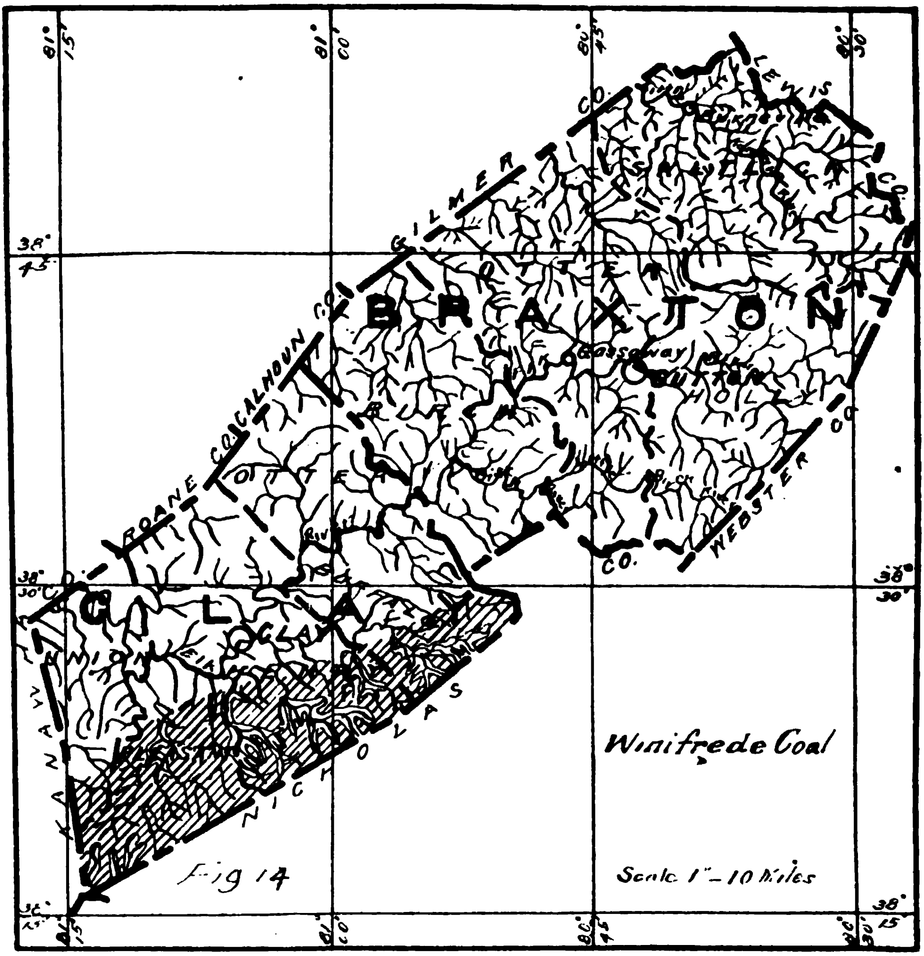

Figure 14—Map Showing Approximate Minable Area of Winifrede Coal. (See Explanations in Author's Preface).

Coal Opening—No. 918 on Map II.

On west hillside of Kanawha Run, 0.6 mile north of Holly; **Winifrede Coal**; elevation, 1025' B.

			Ft.	In.
Shale, bluish-gray, visible			8	0
Coal	0'	8"		
Shale, bluish-gray, sandy, plant fossils	10	0		
Coal, slightly bony	1	3	11	11
Shale, gray			2	0
Shale, sandy, to bed of Kanawha Run			30	0

The above opening, compensating for northwest dip of strata, belongs about 80 feet below the Stockton Coal at **Opening No. 760 on Map II.**

Buffalo District, Clay County.

In the southeast portion of Buffalo District, as shown on Figure 14, the Winifrede Coal appears to attain minable dimensions and persistence, its thickness and position in the measures being indicated in the section given in Chapter IV, pages 115-117, for Widen—3 Miles Northeast; and in the logs of test wells for oil and gas, Nos. 114 and 116 on Map II. In the southwest edge of the District, the two following exposures were examined by Gawthrop:

Coal Exposure—No. 919 on Map II.

In Buffalo Creek and Gauley Railroad cut, east edge of Swandale; **Winifrede Coal**; elevation, 875' B.

	Ft.	In.
Sandstone, massive, **Upper Winifrede**, visible	20	0
Coal	2	0
Shale to Buffalo Creek & Gauley R. R. grade	5	0

The above exposure belongs about 400 feet below the Upper Kittanning Coal, and about 75 feet below the Coalburg bench, according to Gawthrop.

Elk River Coal & Lumber Co. Coal Prospect—No. 920 on Map II.

In ravine, ¼ mile northeast of Cressmont; **Winifrede Coal**; elevation, 910′ B.

			Ft.	In.
Sandstone, massive, Upper **Winifrede**, visible			10	0
Shale, gray			4	0
Coal, gas	0′	3″		
Slate, with **coal** streaks	0	10		
Coal, gas	0	5		
Shale, dark	0	6		
Coal, gas	1	9		
Shale, gray	0	4		
Coal, gas (slate floor)	0	5	4	6

The above opening belongs about 390 feet below the horizon of the Upper Kittanning Coal.

Henry District, Clay County.

In Henry District, the Winifrede Coal in its best development is confined to the southeast portion as in Buffalo (See Figure 14), its thickness and stratigraphic position being exhibited in the sections given in Chapter IV for Wallback and Clay, pages 121 and 129, respectively; and in the log of Well No. 127 on Map II, page 365. In the southeastern point of the District, the two following openings on it were examined by Gawthrop:

Coal Prospect No. 921 on Map II, on west hillside of Dog Run, 0.4 mile southeast of Hickory Fork; **Winifrede Coal**; elevation, 915′ B., was closed and thickness of bed not learned. It is the same seam as that described at **Prospect No. 920,** less than one-fourth mile northwestward.

Coal Opening No. 922 on Map II, on west hillside of Dog Run, 1.1 miles southeast of Hickory Fork; **Winifrede Coal**; elevation, 930′ B.; also closed and thickness not learned.

Coal Exposure—No. 923 on Map II.

In bed of Cove Hollow, 0.9 mile southeast of mouth of Leatherwood Creek; **Winifrede Coal**; elevation, 750′ B.; examined by the writer.

	Ft.	In.
Sandstone, current-bedded, **Upper Winifrede**	15	0
Coal, splinty and bony	1	3
Sandstone, **Lower Winifrede**	30	0

The above exposure belongs about 60 feet below the Coalburg Coal at **Prospect No. 856 on Map II.**

Coal Exposure No. 924 on Map II.

On east bank of branch, north hillside of Elk River, 0.2 mile northeast of mouth of Beechy Creek; **Winifrede Coal**; elevation, 740′ B.; examined by Gawthrop.

	Ft.	In.
Sandstone, massive, to shaly, **Upper Winifrede**	20	0
Coal, weathered	1	6
Shale and sandstone	25	0

The above opening belongs about 400 feet below the Upper Kittanning Coal.

Emily Clark Coal Opening—No. 925 on Map II.

On west hillside of Elk River, 0.15 mile north of mouth of Little Beechy Creek; **Winifrede Coal**; elevation, 705′ B.; examined by Gawthrop.

				Ft.	In.
Sandstone, visible				5	0
Shale				5	0
Coal, gas	0′	5″			
Slate	0	4			
Coal, semi-splint	1	0	**Stockton**	1	9
Sandstone and concealed				64	0
Coal, digging closed, reported, **Winifrede**				1	4

Pleasant District, Clay County.

In Pleasant District, the Winifrede Coal appears to attain a more regular development than elsewhere in either county, its thickness and stratigraphic position being exhibited in the section in Chapter IV, page 153, for Greendale; in the log of the H. O. Heavener No. 1 well—No. 138 on Map II; and the records of Coal Test Borings Nos. 45C, 49, and 50 on Map II.

It has been prospected considerably by natives for local domestic fuel and seldom exceeds 3 feet in thickness and is always multiple-bedded. The following exposure, examined by Gawthrop, belongs about 70 feet below the Coalburg Coal:

Coal Exposure—No. 926 on Map II.

In Coal and Coke Railway cut, 0.3 mile east of mouth of Middle Creek; **Winifrede Coal**; elevation, 710′ B.

			Ft.	In.
Sandstone, **Upper Winifrede**, visible			15	0
Coal	1′	0″		
Fire clay shale	1	6		
Sandstone	4	0		
Shale	2	0		
Coal, slaty	0	6		
Fire clay shale	0	8		
Coal, slaty	1	0	10	8
Fire clay shale			3	0
Concealed and sandstone to Coal & Coke Ry. grade			10	0

The two following openings on Middle Creek were examined by the writer:

Coal Opening—No. 927 on Map II.

On east bank of Middle Creek, 0.8 mile south of Hartland; **Winifrede Coal**; elevation, 740′ B.

			Ft.	In.
Sandstone, makes cliff, **Upper Winifrede**			30	0
Limestone, ferriferous			0	6
Coal, splint	0′	2½″		
Bone, black	0	1½		
Coal, bony	0	3		
Coal, gas, blocky	1	0		
Shale, gray	0	6		
Sandstone	2	6		
Shale, sandy	1	6		
Coal, bony	0	5	6	6
Fire clay shale			5	0
Sandstone			4	0
Shale, gray, sandy, fossil plants and iron ore lenses to bed of creek			5	0

Coal Opening—No. 928 on Map II.

On east bank of Middle Creek, 1.3 miles south of Hartland; **Winifrede Coal**; elevation, 790′ B.

			Ft.	In.
Coal, splint, (sandstone roof)	0′	1″		
Bone	0	1		
Coal, bony	0	7		
Coal, gas	0	10		
Shale, gray	0	0½		
Coal, gas, hard (shale floor)	0	5	2	2½

The section given for **Prospect No. 793** in the Stockton Coal (See pages 706-7) shows the position of the Winifrede Coal in this locality.

Coal Exposure—No. 929 on Map II.

In Coal and Coke Railway cut, 0.4 mile northwest of Hartland; **Winifrede Coal**; elevation, 725′ B.

				Ft.	In.
Interval from **Coalburg Coal blossom**				50	0
Coal, weathered, visible	1′	6″			
Shale, dark, siliceous	10	0			
Coal, weathered	1	6	**Winifrede**	13	0
Sandstone, shaly	5′		**Lower Winifrede**	28	0
Sandstone, massive, to Coal & Coke Ry. grade	23				

The two following openings on Sycamore Creek in the same District (Pleasant) were examined by the writer:

Coal Opening—No. 930 on Map II.

On west bank of Sycamore Creek, ½ mile southeast of Eldorado; **Winifrede Coal**; elevation, 700′ B.

			Ft.	In.
Sandstone, flaggy, visible, **Upper Winifrede**			6	0
Coal, gas	0′	2″		
Slate, dark-gray	0	3		
Coal, gas, hard (slate floor)	1	0	1	5

Coal Opening—No. 931 on Map II.

On east bank of Sycamore Creek, 1.3 miles southeast of Eldorado; **Winifrede Coal**; elevation, 700′ B.

	Ft.	In.
Sandstone, making great cliff, **Upper Winifrede**	40	0
Sandstone, with coal spars at top	7	0
Shale, sandy, flaggy	2	0
Coal, semi-splint, hard, **Winifrede**	1	1
Slate and concealed to bed of Sycamore Creek	6	0

The two following openings, examined by the writer, are located near the Clay—Nicholas County Line:

Coal Opening—No. 932 on Map II.

On west bank of Road Fork, 0.3 mile northwest of Greendale; **Winifrede Coal**; elevation, 1025′ B.

	Ft.	In.
Sandstone, massive, coarse, visible, **Upper Winifrede**	10	0
Coal, semi-splint, bright, hard	2	4
Slate and concealed to bed of Road Fork	6	0

The above opening belongs about 75 feet below the Coalburg Coal and 170 feet below the Kanawha Black Flint.

Coal Opening—No. 933 on Map II.

On north bank of Rockcamp Fork, 0.8 mile northeast of Greendale; **Winifrede Coal**; elevation, 1070′ B.

			Ft.	In.
Sandstone, **Upper Winifrede**, platy, but massive top, visible			25	0
Coal, gas, medium-hard	0′	7½″		
Slate, gray, dark	0	0½		
Coal, gas, medium-hard	1	0	1	8
Shale, gray, visible			8	0

Union District, Clay County.

In Union District, the Winifrede Coal lies entirely below drainage but its stratigraphic position is indicated in the logs of test wells for oil and gas Nos. 151A, 156, 179, 188, 201, 202, 206, 210, and 230 on Map II. These records, however, are unreliable as regards the thickness and character of coal beds encountered, since all are sunk with the churn-drill method.

Quantity of Winifrec

Based on the foregoing evid
Tucker from Map II of the mina
14, the following estimate is ma
of Winifrede Coal available in th

Probable Amount of

Clay County by Districts.	Thickness of Bed Assume Feet.	Square Miles.	Acres.
Buffalo	1.5	19.50	12
Henry	1.5	38.85	24
Pleasant	1.5	48.00	30
Union	1.5	4.25	2
Total		110.60	70,

MARPLETON (CEDAR C

The Marpleton (Cedar Grove
in Chapter VIII, pages 271-272, is
apparently attaining minable thickn
eastern borders of each county, as s
Its outcrop is outlined in detail on
to the waters of Elk and Holly Rive
region it has been opened at countr
local domestic fuel. Its thicknes
diggings and in boring records will
isterial districts.

Holly District, Braxt

In Holly District, the position in
pleton (Cedar Grove) Coal is exhibi
in Chapter IV, pages 100 and 101-3
tralia, respectively. The five follow
Fork of Holly River were examined

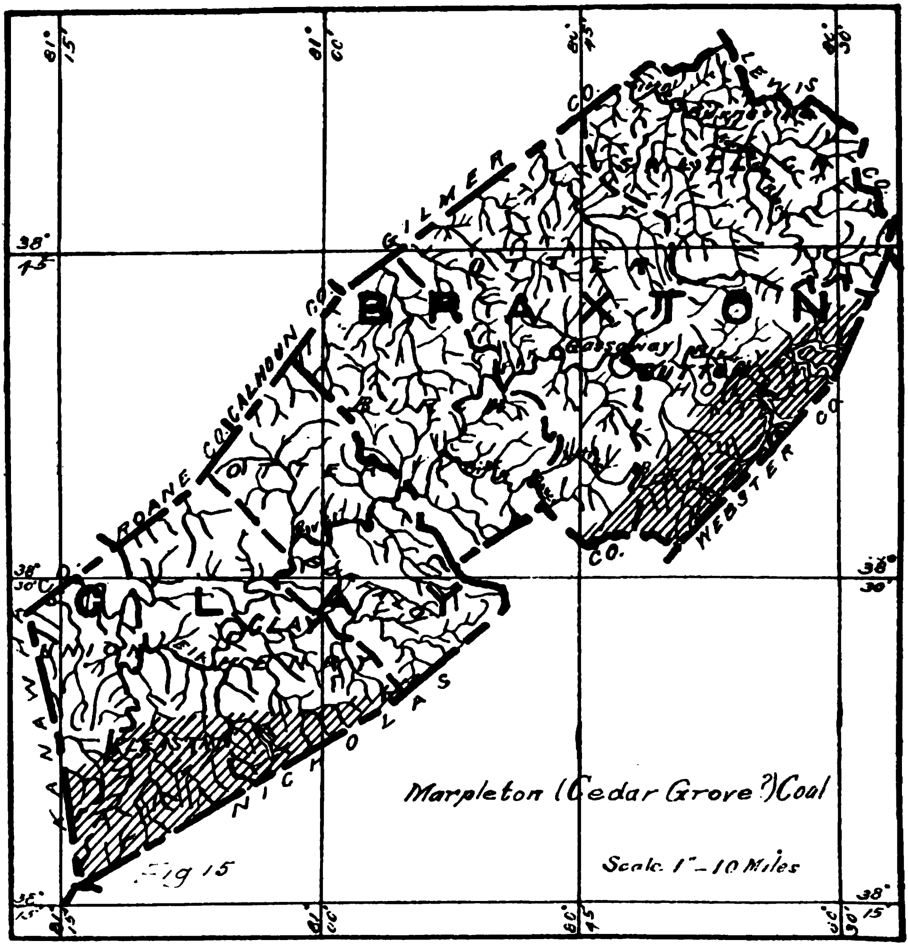

Figure 15.—Map Showing Approximate Minable Area of the Marpleton (Cedar (Cedar Grove) Coal. (See Explanations in Author's Preface).

R. Brewster Heirs Coal Opening—No. 934 on Map II.

On north bank of Left Fork of Holly River, 0.1 mile below Laurelpatch Run; **Marpleton (Cedar Grove) Coal**; elevation, 1030′ B.

	Ft.	In.
Sandstone, shaly..............................	10	0
Shale, brown and dark, with concretions of carbonate of iron, 4" to 6" in diameter.........	7	0
Shale, black, plant fossils......................	1	8
Coal, medium-soft..........................	1	4
Sandstone and shale..........................	15	0

The above opening belongs about 100 feet below **Coal Exposure No. 85 on Map II** of the Holly (Williamson) Coal, and 135 to 140 feet below the horizon of the marine fossiliferous Winifrede Limestone.

Coal Opening No. 935 on Map II, on east bank of Laurelpatch Run, 0.4 mile northeast of No. 934; **Marpleton (Cedar Grove) Coal**; elevation, 1025′ B., closed, reported 16 inches thick.

The details at **E. J. Stump Coal Opening—No. 936 on Map II,** on north hillside of Left Fork, near Marpleton, due north of mouth of Oldlick Creek; **Marpleton (Cedar Grove) Coal**; elevation, 1100′ B.; are published in Chapter IV, page 100, with the Section for Marpleton.

James Fenton Cutlip Coal Opening—No. 937 on Map II.

0.4 mile S. 10° E. of mouth of Oldlick Creek; **Marpleton (Cedar Grove) Coal**; elevation, 1150′ B.; section by Ira Cutlip; digging closed.

			Ft.	In.
Coal, bituminous, 12″ to	1′	2″		
Shale, sandy	4	0		
Cannel coal	1	8	6	10

Not only does its interval below the definitely established Winifrede Limestone place the Marpleton Coal at the horizon of the Cedar Grove of the Kanawha Valley region, but the tendency of the former to carry cannel coal in its bed-section is also one of the characteristic features of the latter in the southern portion of the State.

Coal Opening—No. 938 on Map II.

On point, 0.2 mile due south of mouth of Mudlick Run, just southeast of Marpleton; **Marpleton (Cedar Grove) Coal**; elevation; 1135′ B.; closed, but cannel coal fragments are on dump.

The three following exposures and openings along Right Fork of Holly River in the same District (Holly) were examined by the writer:

Coal Exposure—No. 939 on Map II.

In road, 0.3 mile southeast of Holly; **Marpleton (Cedar Grove) Coal**; elevation, 945′ B.; blossom in road, 1 to 2 feet thick.

Coal Opening—No. 940 on Map II.

On south edge of road, 0.7 mile S. 30° E. of Holly, opposite mouth of Robinson Run; **Marpleton (Cedar Grove) Coal**; elevation, 1010' B.

	Ft.	In.
Shale, brown and sandy, visible	4	0
Slate, black, with Lingula marine fossils	3	0
Coal, medium-hard, bright (slate floor)	2	4

The marine fossils in the roof slates at the above opening are in harmony with conditions prevailing in the same horizon at the type locality of the Cedar Grove Coal in Kanawha County, Mr. Teets and the writer discovering a rich fossil fauna in the roof shales of the latter bed there during the field season of 1916.

Coal Opening—No. 941 on Map II.

On north edge of road, 0.4 mile N. 75° E. of No. 940; **Marpleton (Cedar Grove) Coal**; elevation, 1045' B.; digging closed, reported 2 to 3 feet thick.

Coal Opening No. 942 on Map II, on point, ¼ mile northeast of Centralia; **Marpleton (Cedar Grove) Coal**; elevation, 1150' B.; is shown in the Centralia Section, pages 101-3.

Southward from Centralia, the 5 following exposures and openings were examined by the writer:

Coal Exposure—No. 943 on Map II.

In bed of Laurel Creek, 0.1 mile south of Custis; **Marpleton (Cedar Grove) Coal**; elevation, 1075' B.; 2 feet of bony cannel coal is visible.

Coal Exposure—No. 944 on Map II.

In bed of Laurel Creek, 0.6 mile south of Custis; **Marpleton (Cedar Grove) Coal**; elevation, 1110' B.; shows 6 feet of bony cannel coal.

Reece & McCabe Coal Opening—No. 945 on Map II.

On west bank of Laurel, 100 feet below mouth of Brooks Run; **Marpleton (Cedar Grove) Coal**; elevation, 1120' B.

	Ft.	In.
1. Shale, dark, sandy, visible	6	0
2. **Coal**, bony cannel	6	0
3. Slate, to bed of Laurel Creek	9	0

The analysis of a sample (894H) colle
of section, as reported by Messrs. Hite ar
under **No. 945** in the table of coal analyses
Chapter. Although a good thickness of
this opening, the analytic results show it
too low in British Thermal Units to be of

Coal Exposure—No. 946 o

On west bank of Laurel, just above m
pleton (Cedar Grove) Coal; elevation, 11
gas coal.

Coal Exposure—No. 9

On east hillside of Laurel, 0.3 mil
(Cedar Grove) Coal; elevation, 1150'

Shale, sandy and flaggy, visible.
Slate, black, plant fossils.......
Coal, gas, blocky..............
Sandstone, hard, dark........
Shale, dark, sandy...........
Sandstone, flaggy and shaly, t

Although the above ex
distant from No. 945 on M
feet of cannel has been ent
or "rock" coal.

Henry, Pleasant, an

In Henry, Pleasan
(Cedar Grove?) Coal
and regularity, altho
the possible exceptio
ant where it may cr
Fork. Its thicknes
exhibited in the B
in **Pleasant,** by th
test wells for oil
and the record of
Union, by the l

Quantity of Marpleton (Cedar Grove) Coal Available.

Based on the evidence given above and a determination from Map II by Tucker of the minable area as limited on Figure 15, the following estimate is made for the probable amount of Marpleton (Cedar Grove) Coal available in the territory of this Report:

Probable Amount of Marpleton (Cedar Grove) Coal.

Counties by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Braxton:					
Holly	1.5	51.45	32,928	2,151,515,520	86,060,621
Clay:					
Henry	1.5	22.10	14,144	924,168,960	36,966,758
Pleasant	1.5	47.30	30,272	1,977,972,480	79,118,899
Union	1.5	5.50	3,520	229,996,800	9,199,872
Total for Clay County.....		74.90	47,936	3,132,138,240	125,285,529
Total for both Counties....		126.35	80,864	5,283,653,760	211,346,150

CAMPBELL CREEK (NO. 2 GAS) COAL.

The Campbell Creek (No. 2 Gas) Coal, described briefly in Chapter VIII, page 273, as correlated in this Report, is of secondary importance from a commercial standpoint, its approximate minable area apparently being confined to the southeast border of Clay County, as shown on Figure 5, page 521, along with that for the Bakerstown and Sewell beds. The outcrop of its horizon is confined to the eastern border of **Holly District (Braxton)** on the waters of Holly and Elk Rivers, slightly above midway between that detailed on Map II for the Marpleton (Cedar Grove) and Eagle beds, the only exposure observed being that given with the section under the description of the Campbell Creek Limestone in Chapter VIII. page 272. This appears to represent the Peerless division of the Campbell Creek Coal proper. Its apparent scanty occurrence in the regions of its outcrop, along with the absence of boring logs demonstrating its presence in good thickness, has influenced the writer in not showing minable coal at this horizon in southeastern Braxton on the Figure above mentioned.

In **Clay County,** this coal lies entirely below drainage, but in the southeastern portion it appears to attain minable dimensions, as exhibited in the Beech Fork of Lilly, Lick Branch of Adonijah, and Greendale Sections, published in Chapter IV; in the logs of oil and gas well borings Nos. 128, 130, 144, 206, 208, 232, and 210 on Map II; and in the records of coal test borings Nos. 49 and 50 on Map II.

Quantity of Campbell Creek (No. 2 Gas) Coal Available.

The following estimate is made for the approximate amount of Campbell Creek (No. 2 Gas) Coal available in the territory of this Report, based on the evidence given on preceding pages and a determination by Tucker from Map II of the minable area of the bed as limited on Figure 5:

Probable Amount of Campbell Creek (No. 2 Gas) Coal.

Clay County by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Henry	1.5	17.50	11,200	731,808,000	29,272,320
Pleasant	2.0	37.00	23,680	2,063,001,600	82,520,064
Union	1.5	2.65	1,696	110,816,640	4,432,666
Total		57.15	36,576	2,905,626,240	116,225,050

THE EAGLE COAL.

The Eagle Coal, described in Chapter VIII, pages 274-5, is of secondary importance from a commercial standpoint in the territory of this Report, but attains minable dimensions and regularity in the southeast border of each County, as shown on Figure 4 along with that for the Pittsburgh bed. Its detailed outcrop is given on Map II, where it is shown to be confined to the waters of Holly River above Holly P. O., and Elk River above Bakers Run Station. In this region it has been prospected considerably by natives for local domestic fuel, and in the vicinity of Centralia is locally known as the **"Red Ash"** bed, since it burns into red ashes. The writer was at first inclined to correlate this coal with the Campbell Creek (No. 2 Gas) seam, since it appears to be the first bed approaching minable dimensions below the definitely established Cedar Grove (Marpleton) Coal, but its interval—125 to 140 feet--below the latter is 25 to 40 feet greater than that prevailing in Kanawha County between the Cedar Grove and Campbell Creek beds, where one should expect a less result to be in harmony with the general northeast thinning of the Kanawha Group of the Pottsville Series. Its thickness and character will now be described by magisterial districts.

Holly District, Braxton County.

As shown above, the crop exposures of the Eagle Coal are confined entirely to Holly District. In all other portions of the area it lies below drainage. The four following openings on the waters of Left Fork of Holly River were examined by the writer:

Thomas Parker Coal Opening—No. 948 on Map II.

On south bank of Left Fork, opposite mouth of Mudlick Run; **Eagle Coal**; elevation, 1010′ B.

	Ft.	In.
Shale, dark	5	0
Coal, semi-splint (slate floor)	1	7

Coal Opening—No. 949 on Map II.

On south bank of Left Fork of Holly River, 0.1 mile west of Braxton-Webster County Line; **Eagle Coal**; elevation, 1060′ B.

	Ft.	In.
Coal, opening closed, estimated	1	0
Shale	10	0
Sandstone	20	0
Shale and concealed to railroad grade	45	0

Ira Cutlip Coal Opening—No. 950 on Map II.

On north bank of Oldlick Creek, 0.2 mile southwest of No. 949; **Eagle Coal**; elevation, 1030′ B.

	Ft.	In.
Sandstone, flaggy, visible	15	0
Shale, siliceous	10	0
Coal (digging closed, reported by Ira Cutlip)	2	4

John T. McGraw Coal Opening—No. 951 on Map II.

On north edge of road on Left Fork, 0.8 mile N. 70° E. of No. 949; **Eagle Coal**; elevation, 1085′ B.

	Ft.	In
Shale, dark, plant fossils abundant, visible	12	0
Coal, semi-splint (slate floor)	2	5

A. L. Morrison et al. Coal Opening—No. 952 on Map II.

On south hillside of Right Fork of Holly River, 1.9 miles southeast of Holly P. O.; **Eagle Coal**; elevation, 1035′ B.; examined by the writer.

			Ft.	In.
Sandstone, flaggy and shaly, visible			8	0
Cannel **coal**	0′	6″		
Coal, bituminous	0	10		
Coal, splinty, hard	0	4		
Coal, semi-splint (slate floor)	2	7	4	3

The above opening was once operated by the West Virginia Midland Railroad Company to obtain fuel for its locomotives. Compensating for dip, it belongs about 275 feet below an exposure of the Holly Coal on the same hillside, one-half mile southeastward, an interval that is 25 to 30 feet greater than found in the Marpleton region.

The four following openings along the valley walls of Elk River were examined by the writer:

At **Coal Opening No. 953 on Map II**, on east bank of Elk River, 0.3 mile north of Centralia; **Eagle Coal**; elevation, 950′ B.; 16 inches of coal is visible, the total thickness not being obtained.

Coal Opening—No. 954 on Map II.

On south hillside of Elk River, 2.3 miles N. 80° E. of Centralia; **Eagle Coal**; elevation, 1205′ B.

	Ft.	In.
Sandstone, visible, **Eagle**	3	0
Shale, dark	0	3
Coal, soft	3	2
Fire clay shale, dark, visible	0	4

Coal Opening—No. 955 on Map II.

On east hillside of Elk River, 4.8 miles S. 80° E. of Centralia, and 0.7 mile northeast of Clifton Ford; Eagle Coal; elevation, 1340' B.

			Ft.	In.
Sandstone, Eagle			30	0
Shale			10	0
Bony slate	0'	9"		
Coal, medium-soft	1	10		
Bone	1	0		
Coal, medium-soft (fire clay floor)	1	5	5	0

J. E. McFarland Coal Opening—No. 956 on Map II.

On east hillside of Elk River, 0.6 mile northeast of Clifton Ford; Eagle Coal; elevation, 1360' B.

			Ft.	In.
Sandstone, grayish-brown, platy, visible, Eagle			8	0
Concealed			5	0
Shale, dark-gray, argillaceous, iron ore nodules			7	0
Coal, medium-soft, columnar	1'	7"		
Coal, bony	0	2		
Coal, medium-soft, columnar	0	7		
Bone	0	8		
Coal, medium-soft, columnar	1	4	4	4
Fire clay shale			3	0

The above opening belongs 250 to 260 feet above the outcrop of the Sewell Coal in the same hill.

Brockerhoff Heirs (N. T. McWhorter et al.) Coal Opening—No. 957 on Map II.

On east hillside of Houston Run, 1.3 miles southeast of Centralia; Eagle Coal; elevation, 1210' B.; examined by the writer.

			Ft.	In.
Sandstone, visible, coarse, grayish-brown			2	0
Coal, bony	0'	6"		
Coal, good, medium-hard, blocky	2	0		
Slate, bony	0	4		
Coal, medium-hard	1	4	4	2
Fire clay shale, light-gray			3	0

According to W. T. Diggins of Centralia, the coal at Openings Nos. 954 to 957, inclusive, as also that at the four following openings examined by the writer on the waters of Laurel Creek, burns into a **red ash**:

Coal Opening—No. 958 on Map II.

On west bank of Laurel Creek, 1 mile south of Centralia; **Eagle Coal**; elevation, 1000′ B.

			Ft.	In.
Sandstone, massive, visible, **Eagle**			20	0
Shale, bluish-gray, sandy, plant fossils			7	0
Coal, bony	0′	5″		
Coal, medium-hard, columnar	1	2		
Cannel bone	0	4		
Coal, medium-hard, columnar	0	3		
Cannel bone	0	2		
Coal, medium-hard, columnar	1	2	3	6
Slate, gray, and concealed, to creek			6	0

Coal Exposure—No. 959 on Map II.

On west bank of Laurel Creek, 150 yards south of No. 958; **Eagle Coal**; elevation, 1005′ B.

				Ft.	In.
1.	Sandstone, massive and platy, **Eagle**			25	0
2.	Shale, bluish-gray, sandy, plant fossils			7	0
3.	**Coal**, bony	0′	2″		
4.	**Coal**, medium-soft, columnar	1	5		
5.	Bone, hard	0	2		
6.	**Coal**, medium-soft, columnar	0	8		
7.	Bone, hard	0	9		
8.	**Coal**, medium-soft, columnar	1	1	4	3

The analysis of a sample (897H) collected from Nos. 4, 6, and 8 of above section, as reported by Messrs. Hite and Krak, is given under **No. 959** in the table of coal analyses at the end of this Chapter. The result shows a high percentage of sulphur and ash, a feature that is characteristic of the same bed in the adjoining County of Webster, according to findings of D. B. Reger during 1916.

Coal Opening—No. 960 on Map II.

On west bank of Camp Creek, 0.4 mile south of No. 958; **Eagle Coal**; elevation, 1025′ B.; digging closed, reported 4 feet thick by W. T. Diggins.

Coal Opening—No. 961 on Map II.

On north bank of Camp Creek, 0.7 mile southeast of No. 958; **Eagle Coal**; elevation, 1145' B.

			Ft.	In.
Sandstone, great cliff, **Eagle**			30	0
Shale, sandy, 0" to			5	0
Coal, bony	0'	5"		
Coal	0	8		
Sulphur band, 0" to	0	1		
Coal, medium-hard	1	1		
Coal, bony	0	5		
Coal, medium-hard (slate floor)	1	4	4	0

Quantity of Eagle Coal Available.

Based on the data given on the preceding pages and a planimetric determination by Tucker from Map II of the minable area of the bed, as limited on Figure 4, page 485, the following estimate is made for the probable amount of Eagle Coal available in the two counties:

Probable Amount of Eagle Coal.

Counties by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Braxton:					
Holly	2.5	36.00	23,040	2,509,056,000	100,362,240
Clay:					
Buffalo	2.0	9.80	6,272	546,416,640	21,856,666
Henry	2.0	23.35	14,944	1,301,921,280	52,076,851
Pleasant	2.0	25.90	16,576	1,444,101,120	57,764,045
Total for Clay County		59.05	37,792	3,292,439,040	131,697,562
Total for both Counties		95.05	60,832	5,801,495,040	232,059,802

MINABLE COALS OF THE POTTSVILLE SERIES, NEW RIVER GROUP.

THE SEWELL COAL.

The Sewell Coal of White*, belonging at its type locality—Sewell Mountain, Fayette County—about 400 feet below the base of the Kanawha Group and 60 to 80 feet above the top of the Upper Raleigh Sandstone, appears to be the only bed of the New River Group of the Pottsville Series that attains minable dimensions and regularity in the territory of this Report, its approximate minable area being shown on Figure 5, page 521, along with that for the Bakerstown and Campbell Creek (No. 2 Gas) seams. It lies entirely below drainage in each county, but it has been prospected considerably along the valley walls of Elk River 3 to 5 miles eastward from Centralia, in the west edge of Webster County, where its bed-section is almost a duplicate of that prevailing along New River in Fayette County between Hawks Nest and Thurmond. The 5 following prospect openings in this region were examined by the writer, where the coal belongs 250 to 260 feet below the Eagle bed:

Coal Opening—No. 962 on Map II.

On east bank of Elk River, 3.5 miles N. 80° E. of Centralia, in Webster County; **Sewell Coal**; elevation, 1060′ B.

				Ft.	In.
Shale, dark, flaggy, and sandy				7	0
Coal, soft	1′	0″			
Shale, with coal streaks at bottom	10	0			
Shale, with coal streaks	2	0			
Coal, slaty	2	0	**Sewell "B"**	15	0
Concealed and dark shale				29	0
Coal, prospect closed, **Sewell**, reported by Mr. W. T. Diggins 52″ thick with 12″ cannel bone at top				4	4

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*I. C. White, The Virginias, pp. 7-16; January, 1885; Bull. 65, U. S. G. Survey, p. 197; 1891; and Vol. II, W. Va. Geol. Survey, pp. 657-665; 1903.

The **Sewell "B" Coal** of the writer** appears to be represented at the above opening, as also at No. 966 below.

J. E. McFarland Coal Opening—No. 963 on Map II.

On east bank of Elk River, 0.3 mile southeast of No. 962; in Webster County; **Sewell Coal**; elevation, 1065' B.

			Ft.	In.
Shale, sandy, visible			5	0
Coal, cannelly, bony	1'	0"		
Coal, soft (slate floor)	3	4	4	4

The bony cannel at top is one of the characteristic features accompanying the Sewell Coal along New River above Hawks Nest in Fayette County. In the vicinity of the above opening, the stratigraphic position of this bed is shown in the section given in Chapter IV, pages 103-4, for Centralia—3.5 Miles East.

Coal Opening—No. 964 on Map II.

In bed of Gulf Run, south side of Elk River, 1.2 miles northwest of Clifton Ford, in Webster County; **Sewell Coal**; elevation, 1055' B.

			Ft.	In.
Sandstone, visible			3	0
Shale, sandy, iron ore lenses			1	6
Coal, cannelly, visible	1'	2"		
Coal, soft (dark slate floor)	3	1	4	3

John E. Roller Coal Opening—No. 965 on Map II.

On west hillside of Elk River, 0.3 mile southwest of Clifton Ford, in Webster County; **Sewell Coal**; elevation, 1080' B.

			Ft.	In.
Sandstone, shaly, visible			12	0
Shale, bluish-gray, sandy, iron ore nodules			5	0
Coal, cannelly	1'	0"		
Coal, soft	3	10	4	10
Fire clay shale			6	0
Sandstone cliff, **Welch**, to river			50	0

**Ray V. Hennen, Wyoming-McDowell Report, W. Va. Geol. Survey, pp. 195-6; 1915.

The writer collected a sample (898H) of the bottom bench at the above opening for analysis, the composition of which, as reported by Messrs. Hite and Krak, is published in the table of coal analyses at the end of this Chapter under **No. 965.** The results show a high-grade coal as regards the sulphur, phosphorus, and ash content, but about 11 per cent. more volatile matter and 500 B. T. U's. less per pound of coal than in the New River region, a feature that is in harmony with other tests of this bed northeastward across the State from Fayette County.

Javis Brooks Coal Opening—No. 966 on Map II.

On west side of Elk River, ½ mile northwest of No. 964, in Webster County; **Sewell Coal**; elevation, 1040' B.

		Ft.	In.
Shale, sandy, iron ore nodules, visible		5	0
Shale, dark, thin coal streaks		0	9
Coal, slaty	0' 5"		
Coal, soft	2 10 **Sewell "B"**	3	3
Fire clay shale, sandy		6	0
Sandstone		8	0
Shale, dark, sandy		0	10
Coal, cannelly, slightly bony	1' 1"		
Coal, soft (fire clay shale floor)	2 8 **Sewell**	3	9

Holly District, Braxton County

In Holly District, the Sewell Coal is believed to attain minable dimensions and regularity as shown on Figure 5, page 521, in view of its showing at the above described openings in Webster County where the seam first rises above the bed of Elk River, and the thickness recorded of what appears to be the same coal in the logs of wells Nos. 109D and 109F on Map II, that of the latter being used in connection with the section for Centralia, page 101. In other Districts in each County, the logs of oil and gas well borings frequently fail to record any coal at this horizon although a showing at what appears to be its horizon is recorded at 8 or 10 scattered wells. Well No. 127 on Map II in the edge of Nicholas County, see page 366, records 2 feet of coal at this horizon, while the log of No. 133—used in connection with the Lick Branch of Adonijah Section, page 149—very carefully kept in detail, reveals its absence. It has been well established that the coals of the Pottsville Series tend to thin away to the northwestward, so that in view of its scanty occurrence along the Clay-Nicholas Line, as revealed by the logs last mentioned, it is hardly probable that much coal will ever be found at this horizon, other than in the area designated on Figure 5.

Quantity of Sewell Coal Available.

Based on the foregoing evidence and a planimetric determination by Tucker from Map II of the minable area of the bed as limited on Figure 5, page 521, the following estimate is made for the probable amount of Sewell Coal available in the territory of this Report, the thickness of the bed assumed being about half that found at the prospect openings on it described above:

Probable Amount of Sewell Coal.

Braxton County by Districts.	Thickness of Bed Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Holly	2.0	47.50	30,400	2,648,448,000	105,937,920

SUMMARY OF AVAILABLE COAL.

There is given on preceding pages of this Chapter at the end of the description of each of the 15 minable coals an estimate of the available tonnage of each bed by magisterial districts along with the totals for each County. The following table, with the coals arranged in descending order, gives a summary of these estimates:

Summary of Available Coal.

Name of Coal Bed.	Mines and Prospects listed by numbers on Map II and described in this Chapter.	Short tons of coal–2000 lbs.	
		Clay County	Braxton County
Pittsburgh	89-228	311,369,074	35,227,146
Bakerstown	229-278	89,383,726	
Upper Freeport	279-338	313,576,240	43,546,060
Lower Freeport	339-360	35,267,915	
Upper Kittanning	361-518	399,246,566	510,314,111
Middle Kittanning	519-548	37,134,029	275,884,646
No. 5 Block (Lower Kittanning)	549-729, 734	642,764,390	691,830,373
Little No. 5 Block—Clarion	730-733, 735-747		96,013,209
Stockton	748-807	202,229,912	421,409,894
Coalburg	808-916		605,435,212
Winifrede	917-933		185,001,062
Marpleton (Cedar Grove)	934-947	86,060,621	125,285,529
Campbell Creek (No. 2 Gas)			116,225,050
Eagle	948-961	100,362,240	131,697,562
Sewell	962-966	105,937,920	
Total for each County		2,323,252.633	3,237,869,854
Total for both Counties			5,561,202,487

The above summary is believed to represent approximately the amount of minable coal that was available before commercial operations were begun in 1904. The table at the beginning of this Chapter, page 456, shows that the total coal produced from both counties to June 30, 1915, was 3,290,108 long tons=3,685,000 short tons in round numbers. For the two years that will have elapsed on the issue of this Report, probably enough will have been mined to bring the total up to 6,000,000 short tons, which sum should be deducted from the above summary of available coal, thus leaving in round numbers 5,555,000,000 short tons. Allowing for a recovery of 80 per cent., the total coal that may eventually be mined is in round numbers 4,444,000,000 short tons.

MINABLE COAL BY MAGISTERIAL DISTRICTS.

All the minable coal beds have been described on preceding pages of this Chapter by magisterial districts. In the Index at the end of this Report, under the heading "Minable Coal by Magisterial Districts", will be found a list of page references, a feature that facilitates investigation of the coal resources in any special area of either County by rendering all the information herein contained readily available.

TABLE OF COAL ANALYSES.

The following table, containing the chemical analysis, calorific determination, and fuel ratio of 36 prospects and mines, is the exclusive work of members of the Survey Staff. All the samples, except those mentioned with the description of the opening, were collected by members of the force in the field. Those from the commercial mines were taken according to methods prevailing with the U. S. Bureau of Mines, the coal being quartered down and sealed in tins in the mines. The samples from country banks and prospect openings were collected in small sacks with as much care as possible when depending on a scanty saddle-bag equipment. The chemical work was mostly done by J. B. Krak, Assistant Chemist, under the direction and with the assistance of B. H. Hite, Chief Chemist. The numbers in the left-hand margin correspond to those given with the description of the opening or mine and with the mine symbols on Map II. The portion of the bed sampled is mentioned with the description of the opening. The table of analyses is followed immediately by another giving the accurate location of the corresponding prospect or mine and page references to its description:

TABLE OF COAL ANALYSES.

					PROXIMATE.				Common to Both.		ULTIMATE						
No. on Map II.	Mine.	County.	Coal Bed.	Condition of Sample.	Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Calorimeter, B. T. U. for 1 lb. of Coal.	Calculated B. T. U. for 1 lb. of Coal.	Carbon Divided by Oxygen + Ash.
1	Smith Marks	B.	Uniontown, M. S.	A. R.	1.80	42.70	46.65	0.015	8.85	3.63	.....	.....	.....	.....	......	......	.....
90	Davis Colliery Co., Mine No. 6	B.	Pittsburgh, M. S.	A. D.	1.80	38.44	53.20	0.011	6.56	2.12	75.94	5.10	9.25	1.08	13,689	13,588	4.80
90	Davis Colliery Co., Mine No. 6	B.	Pittsburgh, M. S.	A. R.	2.33	38.24	52.90	0.011	6.53	2.11	75.53	5.16	9.64	1.03	13,615	13,527	4.67
93	G. B. Carter	B.	Pittsburgh, M. S.	A. R.	1.35	40.35	52.04	0.009	6.26	1.81	.....	.....	.....	.....	......	......	.....
94	Davis Colliery Co., Mine No. 11	B.	Pittsburgh, M. S.	A. D.	1.90	38.46	52.86	0.016	6.78	2.48	75.00	5.26	9.46	1.02	13,717	13,539	4.62
94	Davis Colliery Co., Mine No. 11	B.	Pittsburgh, M. S.	A. R.	2.53	38.22	52.51	0.016	6.74	2.47	74.52	5.83	9.92	1.02	13,629	13,475	4.47
162	H. B. Starkey	B.	Pittsburgh, U. & L. B.	A. R.	2.30	39.03	52.68	0.009	5.99	1.70	.....	.....	.....	.....	......	......	.....
162	H. B. Starkey	B.	Pittsburgh, M. B.	A. R.	2.00	41.56	50.94	0.004	5.50	1.61	.....	.....	.....	.....	......	......	.....
167	John Cole	B.	Pittsburgh, M. S.	A. R.	2.30	40.70	51.59	0.005	5.41	2.25	.....	.....	.....	.....	......	......	.....
175	Theodore M. Coulter	B.	Pittsburgh, M. S.	A. D.	1.80	35.40	57.48	0.003	5.32	1.65	75.82	6.11	10.46	0.64	13,972	14,071	4.80
180	William Tucker	B.	Pittsburgh, M. S.	A. R.	1.83	39.67	49.80	0.006	8.70	2.80	72.76	4.92	9.56	1.26	13,110	13,010	3.98
	Average		Pittsburgh	A. D.	1.83	37.43	54.52	0.010	6.22	2.08	75.59	5.49	9.72	0.90	13,793	13,733	4.74
	Average		Pittsburgh	A. R.	2.09	39.68	51.78	0.009	6.45	2.11	74.27	5.14	9.71	1.10	13,451	13,337	4.37
262	A. H. Bright	B.	Bakerstown, M. S.	A. R.	0.92	36.63	51.15	0.035	11.30	1.59	73.35	5.10	7.39	1.18	13,230	13,380	3.93
315	E. J. Hall	B.	Upper Freeport, M. S.	A. R.	1.50	38.32	52.18	0.005	8.00	2.53	74.67	5.35	8.33	1.12	13,520	13,640	4.57
392	Charles Duffield	B.	Upper Kittanning, M. S.	A. R.	0.68	35.02	48.05	0.004	16.25	0.93	67.33	4.98	9.42	1.09	12,520	12,190	2.62
408	J. I. Burton	B.	Upper Kittanning, M. S.	A. R.	2.04	36.81	52.85	0.003	8.30	0.58	.....	.....	.....	.....	......	......	.....
436	William Callison	C.	Upper Kittanning, M. S.	A. R.	1.18	42.32	47.65	0.004	8.85	3.27	74.32	5.09	7.14	1.33	13,440	13,550	4.65
473	J. C. Stone	C.	Upper Kittanning, M. S.	A. R.	1.66	39.64	53.96	0.008	4.74	0.80	77.13	5.51	10.59	1.23	13 970	13,850	5.03
490	Queen Shoals Coal Co.	C.	Upper Kittanning, M. S.	A. R.	1.09	38.14	54.88	0.005	5.89	0.93	.....	.....	.....	.....	......	......	.....
	Average		Upper Kittanning, M. S.	A. R.	1.33	38.39	51.48	0.005	8.80	1.30	72.93	5.19	9.05	1.22	13,310	13,197	4.10
520	W. Va. Midland R. R.	B.	Middle Kittanning, M. S.	A. R.	1.40	33.30	58.86	0.009	6.44	0.74	82.19	4.51	4.95	1.17	14,461	14,396	7.21
540A	Middle Creek C. & C. Co.	C.	Middle Kittanning, M. S.	A. R.	3.39	39.15	50.58	0.005	6.88	0.80	74.83	5.03	11.36	1.10	12,830	13,150	4.10
	Average		Middle Kittanning, M. S.	A. R.	2.39	36.23	54.72	0.007	6.66	0.77	78.51	4.77	8.15	1.14	13,646	13,773	5.66
561	Taylor Brohard	B.	No. 5 Block (Lower Kittanning), M. S.	A. R.	0.94	36.82	57.74	0.004	4.50	0.82	.....	.....	.....	.....	......	......	.....
576	Jennie Kniceley	B.	No. 5 Block (Lower Kittanning), M. S.	A. R.	1.50	37.30	56.46	0.007	4.74	1.17	.....	.....	.....	.....	......	......	.....
620	C. W. (John) Taylor Heirs	B.	No. 5 Block (Lower Kittanning), M. S.	A. R.	1.50	37.94	53.86	0.004	6.70	1.21	76.08	5.32	9.32	1.37	13,800	13,690	4.87
677A	Elk River C. & L. Co. ("Rich Run")	C.	No. 5 Block (Lower Kittanning), M. S.	A. D.	1.06	34.59	55.87	0.006	8.48	0.65	77.04	5.04	7.57	1.22	13,600	13,770	4.80
677A	Elk River C. & L. Co. ("Rich Run")	C.	No. 5 Block (Lower Kittanning), M. S.	A. R.	1.25	34.53	55.76	0.006	8.46	0.65	76.89	5.05	7.74	1.21	13,580	13,750	4.75
677A	Elk River C. & L. Co. ("Rich Run")	C.	No. 5 Block (Lower Kittanning), L. B.	A. D.	1.28	33.92	55.23	0.004	9.57	0.59	76.14	5.02	7.44	1.24	13,400	13,630	4.48

TABLE OF COAL ANALYSES (CONTINUED).

					PROXIMATE.				Common to Both.		ULTIMATE						
No. on Map II.	Mine.	County.	Coal Bed.	Condition of Sample.	Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Calorimeter, B. T. U. for 1 lb. of Coal.	Calculated B. T. U. for 1 lb. of Coal.	Carbon Divided by Oxygen + Ash.
677A	Elk River C. & L. Co. ("Rich Run")	C.	No. 5 Block (Lower Kittanning), L. B..	A. R.	1.59	33.82	55.05	0.004	9.54	0.59	75.90	5.05	7.69	1.23	13,360	13,590	4.41
677A	Elk River C. & L. Co. ("Rich Run")	C.	No. 5 Block (Lower Kittanning), Bot...	A. D.	1.58	36.49	52.31	0.005	9.62	0.77	74.31	4.98	9.16	1.16	13 360	13,220	3.96
677A	Elk River C. & L. Co. ("Rich Run")	C.	No. 5 Block (Lower Kittanning), Bot...	A. R.	1.88	36.38	52.15	0.005	9.59	0.77	74.09	5.00	9.40	1.15	13,320	13,180	3.85
687	Elliott Splint Coal Co.	C.	No. 5 Block (Lower Kittanning) M. S..	A. R.	1.17	37.30	55.86	0.006	5.67	0.93	79.12	5.24	7.74	1.30	14,220	14,190	5.90
709	P. N. Stone	C.	No. 5 Block (Lower Kittanning) M. S..	A. R.	1.30	36.70	55.40	0.004	6.60	0.88	77.86	5.11	8.38	1.17	13,780	13,880	5.20
709	P. N. Stone (Krebs)	C.	No. 5 Block (Lower Kittanning) M. S..	A. R.	1.36	30.59	60.63	0.007	7.42	1.42	.....	.....	.....	.....	13,570	......	.....
716	H. A. Walker	C.	No. 5 Block (Lower Kittanning) M. S..	A. R.	1.32	32.78	60.09	0.005	5.81	0.77	.....	.....	.....	.....	13,736	......	.....
	Average		No. 5 Block (Lower Kittanning) M. S..	A. R.	1.29	35.49	56.98	0.005	6.24	0.98	77.49	5.14	8.29	1.26	13,781	13,878	5.18
735	W. H. Smallwood	B.	Clarion—Little No. 5 Block, M. S.	A. R.	1.34	37.61	56.92	0.002	4.13	0.84	.....	.....	.....	.....	......	......	.....
848	Elliott Splint Coal Co.	C.	Coalburg, U. B.	A. D.	1.60	38.22	56.03	0.005	4.15	0.74	80.13	5.24	8.52	1.22	14,330	14,270	6.32
848	Elliott Splint Coal Co.	C.	Coalburg, U. B.	A. R.	1.83	38.13	55.90	0.005	4.14	0.74	79.95	5.25	8.71	1.21	14,300	14,240	6.22
848	Elliott Splint Coal Co.	C.	Coalburg, L. B.	A. D.	1.30	38.40	53 20	0.003	7.10	0.92	77.07	5.08	8.56	1.27	13 780	13,780	4.92
848	Elliott Splint Coal Co.	C.	Coalburg, L. B.	A. R.	1.50	38.32	53.10	0.003	7.08	0.92	76.91	5.08	8.75	1.26	13,750	13,700	4.86
848	Elliott Splint Coal Co.	C.	Coalburg, Bot.	A. D.	0.96	37.79	46.58	0.005	14.67	0.70	70.66	5.04	7.62	1.31	12,740	12,840	3.17
848	Elliott Splint Coal Co.	C.	Coalburg, Bot.	A. R.	1.16	37.72	46.48	0.005	14.64	0.70	70.51	0.05	7.80	1.30	12,710	12,810	3.14
848	Elliott Splint Coal Co. (Krebs)	C.	Coalburg, U. B.	A. R.	1.47	34.03	53.54	0.004	10.96	1.06	.....	.....	.....	.....	12,953	......	.....
848	Elliott Splint Coal Co. (Krebs)	C.	Coalburg, L. B. & Bot.	A. R.	1.17	32.39	56.85	0.004	9.59	0.66	.....	.....	.....	.....	13,226	......	.....
868	Dorfee Coal Mining Co.	C.	Coalburg, M. S.	A. D.	1.75	31.20	58.36	0.006	8.69	1.11	76.36	4.44	8.19	1.21	13,164	13,272	4.52
874	Samuel Stephenson	C.	Coalburg, M. S.	A. R.	1.90	34.33	58.24	0.004	5.53	0.69	.....	.....	.....	.....	14,123	......	.....
885	Serena Brown	C.	Coalburg, M. S.	A. R.	1.50	38.57	54.38	0.005	5.55	0.78	79.07	5.04	8.37	1.19	14,060	14,010	5.75
891	L. T. Jones	C.	Coalburg, M. S.	A. R.	1.75	32.34	57.17	0.006	8.74	1.03	.....	.....	.....	.....	13,245	......	.....
899	Ridgewood Coal Co. ("Raven")	C.	Coalburg, M. S.	A. D.	2.00	33.70	57.90	0.005	6.40	0.70	79.09	5.33	7.46	1.02	14,176	14,260	5.71
899	Ridgewood Coal Co. ("Raven")	C.	Coalburg, M. S.	A. R.	2.18	33.64	57.79	0.005	6.39	0.70	78.95	5.35	7.59	1.02	14,151	14,240	5.65
902	Coalbell Coal Co. ("Carter")	C.	Coalburg, M. S.	A. D.	2.00	33.65	57.37	0.010	6.98	0.90	75.82	5.56	9.75	0.99	13,964	13,756	4.53
902	Coalbell Coal Co. ("Carter")	C.	Coalburg, M. S.	A. R.	2.47	33.50	57.08	0.010	6.95	0.90	75.47	5.61	10.08	0.99	13,898	13,711	4.43
903	Coalbell Coal Co. ("Scott")	C.	Coalburg, M. S.	A. D.	1.75	32.00	52.16	0.030	14.09	0.76	72.55	4.44	7.30	0.86	13,093	12,772	3.40
903	Coalbell Coal Co. ("Scott")	C.	Coalburg, M. S.	A. R.	2.10	31.89	51.96	0.030	14.05	0.76	72.30	4.48	7.55	0.86	13,047	12,741	3.35
	Average		Coalburg, M. S.	A. D.	1.87	32.64	56.45	0.008	9.04	0.87	75.96	4.94	8.17	1.02	13,599	13,515	4.54
	Average		Coalburg, M. S.	A. R.	1.98	34.05	56.10	0.010	7.87	0.81	76.45	5.12	8.40	1.01	13,754	13,675	4.70
945	Reece & McCabe	B.	Marpleton (Cedar Grove), M. S.	A. R.	0.54	30.96	34.10	0.050	34.40	0.67	53.10	3.98	6.80	1.05	9,500	9.690	1.29
959		B.	Eagle, M. S.	A. R.	0.87	36.38	50.02	0.004	12.78	3.63	70.45	5.16	6.68	1.35	13,030	13 080	3.63
965	John E. Roller	W.	Sewell, M. S.	A. R.	1.10	30.75	62.65	0.005	5.50	0.67	81.76	5.01	6.01	1.05	14,400	14,560	7.10

Table Showing Location of Prospects and Commercial Mines Represented by Analyses in Preceding Table, and Page References to their Description.

(Commercial Mines marked thus "*".)

No. on Map II.	Sample No.	Location of Prospect or Mine.	Page of this Report.	Other Report References.
1	164G	Progress, 0.6 mi. N. E......	173	....
90*	....	Copen, 1.5 mi. due N.......	486	Vol. II(A), pp. 664-5, 668.
93	161G	Copen, 0.8 mi. N. E........	487	
94	....	Copen, 0.4 mi. due N.......	488	Vol. II(A), pp. 664 and 668.
162	165Ga 165Gb	Belfont, 0.6 mi. N. E.......	502	....
167	163G	Clickton, ¼ mi. due E.....	503	....
175	....	Coon Knob, ¾ mi. N. W...	505	Vol. II(A), pp. 665 and 667.
180	892H	Teeny Knob, 0.3 mi. S.....	507	....
262	885H	Corley, 0.8 mi. N.........	527	....
315	168G	Centralia, 3.5 mi. S. W.....	541	....
392	896H	Sutton, 1.5 mi. S. E.......	570	....
408	166G	Ramp Run P. O., 0.4 mi. N..	574	....
436	172G	Groves, 1.4 mi. due E......	584	....
473	171G	Lizemores, 1.2 mi. due S...	593	....
490	....	Queen Shoals, 0.5 mi. W...	598	Vol II, p. 287. Vol. II(A), p. 530.
520	....	Palmer, 0.5 mi. N. W......	97	Vol. II(A), pp. 522-3.
561	888H	Wildcat, 2¼ mi. due W....	628	....
576	162G	Marpleton, 2 mi. N. 8° W..	632	....
620	167G	Jennings, 0.6 mi. S. E......	645	....
677A*	902H 903H 904H	Widen, 0.5 mi. S. E........	657	....
687	383K	Road Fork, Leatherwood Creek, 1.6 mi. E.......	663	....
709	901H	Lizemores, 1.6 mi. N. 80° E.	672	....
716	Krebs[1]	Lizemores, 1.2 mi. S. E.....	675	....
735	895H	Little Birch P. O., 0.9 mi. S. W.................	684	....
848*	905H 906H 907H	Clay, ¾ mi. due S.........	725	....
868	....	Dorfee, Clay County.......	732	Vol. II(A), pp. 441 and 466.
874	Krebs[1]	On Lick Branch of Middle Creek	735	....
885	990H	Lizemores, 2.1 mi. N. E....	738	....
891	Krebs[1]	Lizemores, 3 mi. N. 70° E..	740	....
899*	....	Greendale, 0.2 mi. S. W....	742	Vol. II(A), pp. 461-2.
902*	....	Carterboro, 0.2 mi. N. E...	743	Vol. II(A), p. 459; Bull. 2, p. 284.
903*	....	Carterboro, 0.2 mi. S. W....	743	Vol. II(A), pp. 458-9; Bull. 2, p. 284.
945	894H	Centralia, 2.7 mi. S. 25° W..	760	....
959	897H	Centralia, 1 mi. S. 25° W...	767	....
965	898H	Centralia. 4.3 mi. S. 75° E..	770	....

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[1] Sampled by C. E. Krebs, former member of Survey Staff.—R. V. H.

CHAPTER XI.

CLAY, ROAD MATERIAL, LIMESTONE, BUILDING STONE, IRON ORE, SALT, WATER-POWER AND FORESTS.

CLAYS AND ABSENCE OF CLAY INDUSTRY.

As in previous County Reports attention has been called to Volume III of the State Geological Survey by G. P. Grimsley, published in 1905, in which is given a general review of clays and the clay industry in West Virginia, along with an exhaustive discussion of the origin, chemical, and physical properties and classification of clays, to which reference is made for such information, as also the technology of the industry.

ABSENCE OF DEVELOPMENT.

There is not a single brick or pottery plant utilizing clays or shales within the territory of this Report, although there is practically an inexhaustible supply of the raw material, in addition to an abundant source of cheap fuel—natural gas and coal—with which to burn it. The large and growing demand for both building and paving brick, due to the growth of mining towns associated with the increasing coal industry and the great revival of interest in recent years of permanent road surfaces, certainly warrants the establishment of plants for the manufacture of brick, the nearest available sources of supply for the latter being at Weston, Lewis County, on the northeast, and Charleston, Kanawha County, on the southwest.

AVAILABLE CLAY.

Transported Clay.

Transported clay of the alluvial form, represented by the Quaternary on Map II—unconsolidated clays, sand beds, and gravel on the flood-plains and terraces of the Little Kanawha and Elk Rivers and their larger tributaries—occur in vast deposits, ranging in thickness from 5 to 30 feet. Since a large percentage of these deposits is derived from the argillaceous beds of the Monongahela and Conemaugh Series, they should run sufficiently high in aluminous material to burn into a fair quality of building brick. The location of any plant to develop these beds should be selected with the idea of securing the most favorable point for the distribution of the manufactured product, amount of alluvial clay available, cheapness of fuel, and lowest expense of handling the raw material. A study of Map II and the existing steam railway lines shows that the Burnsville region best fills these requirements along the Little Kanawha River; while the same is true for the bottoms along Elk from Centralia to Gillespie; Wolf Creek to Strange Creek; Buffalo Creek to Sycamore Creek; and Dulls Creek to Queen Shoals.

Residual Clay.

Residual clay, not transported but derived from the weathering of rocks **in situ**, does not occur in sufficient amount and purity to be classed as a commercial asset in the clay resources of Braxton and Clay, its chief economic worth being judged more by its effect on the soil for agricultural purposes.

Stratified Shales.

The argillaceous shales of the Conemaugh and Allegheny Series, both of which divisions of the rock column are outlined on Map II, constitute by far the greatest source of supply of the raw material for the manufacture of both building and paving brick that may be found in either county. The same is true to a probably less extent for the Monongahela Series, but the more or less siliceous nature of the shales of the Pottsville and their more or less irregular occurrence render their value problematical. It is true, however, that shales somewhat high in aluminous material prevail in the lower half of the Kanawha Group. The outcrop of the latter along feasible transportation lines is confined to low down on the valley walls of Holly River above Holly; and Elk River, above Palmer.

The Pittsburgh Red Shale.

The Pittsburgh Red Shale of the Conemaugh Series, described fully in Chapter VI, page 210, has been successfully used in other portions of the State for the manufacture of roofing tile and of both building and paving brick. It ranges in thickness from 40 to 60 feet in the territory of this Report and constitutes what is probably the greatest single source of supply of raw material for the purposes suggested, its physical appearance being practically the same as in the regions of West Virginia where it is already utilized. Gawthrop collected a sample for analysis and measured the following section at its crop exposure along the Coal and Coke Railway grade, opposite the mouth of Walnut Fork, slightly over a mile northeast of Gassaway:

		Feet.
1.	Concealed	
2.	Shale, red, with greenish tinge	6
3.	Shale, greenish-gray, with red tinge	6
4.	Shale, red, with few limestone nodules	5
5.	Shale, blue	1
6.	Sandstone to railroad grade	1

The composition of the sample, taken from Nos. 2 to 5 of the above section, as reported by Messrs. Hite and Krak under No. 170G, is as follows:

	Per cent.
Silica (SiO_2)	45.69
Ferric Iron (Fe_2O_3)	7.00
Alumina (Al_2O_3)	14.69
Lime (CaO)	11.40
Magnesia (MgO)	1.96
Potassium (K_2O)	2.76
Sodium (Na_2O)	1.39
Titanium (TiO_2)	0.66
Phosphoric Acid (P_2O_5)	0.71
Moisture	2.15
Loss on ignition	12.05
Total	100.46

The above results indicate that the sample collected runs too high in lime for the successful manufacture of brick, which also accounts for the high percentage of loss on ignition. This no doubt was largely due to the inclusion in the sample of No. 4 of section by Gawthrop, which, owing to its limestone nodules, should have been omitted. The Pittsburgh Red Shales have been operated successfully for raw material in the manufacture of brick at too many other points in the State to warrant discouragement from this analysis. In the territory in question, there are many exposures of this shale that are comparatively free of limestone. Since it belongs only 50 to 60 feet above the Bakerstown Coal, its outcrop should follow closely the same regions as outlined on Map II for the latter bed.

Fire Clay.

The outcropping rocks of Braxton and Clay, so far as observed, with possibly one or two exceptions, carry only impure fire clay shales along with their associated coal beds, which apparently run too high in the easily fusible components—ferric iron, lime, and the alkalies—for the manufacture of fire brick and other ware possessing high refractory qualities, but sufficiently low to burn into a fair quality of building and paving brick and possibly pottery ware.

In Birch District, Braxton County, 5 feet of a fair flint clay crops in the public road on the west side of Elk River, ¾ mile due south of Frametown, at an elevation of 1000′ L., directly below the horizon of the Bakerstown Coal and slightly over 300 feet above that of the Upper Kittanning bed. The writer collected a sample of the clay here for analysis, the composition of which, as reported by Messrs. Hite and Krak under No. 893H, is as follows:

	Per cent.
Silica (SiO_2)	62.45
Ferric Iron (Fe_2O_3)	6.84
Alumina (Al_2O_3)	19.01
Lime (CaO)	0.20
Magnesia (MgO)	0.12
Potassium (K_2O)	0.74
Sodium (Na_2O)	0.61
Titanium (TiO_2)	0.61

	Per cent.
Phosphoric Acid (P_2O_5)	0.71
Moisture	2.25
Loss on ignition	6.85
Total	99.77

With the possible exception of ferric iron, the foregoing results indicate a clay sufficiently low in the fusible components for the manufacture of fire brick. It should burn into a fair grade of pottery ware, as also building and paving brick. The fairly high iron content should give the resulting brick a beautiful red color. The areal extent of this clay appears to be extremely local, since it was observed, in this character, at only one other locality, this being an exposure of about the same thickness at an elevation of 890′ B., in the public road, 4½ miles due westward and about ½ mile east of Servia, at practically the same interval above the Upper Kittanning Coal horizon.

In the northwest corner of Holly District (Braxton), a thick deposit of fire clay shale crops immediately below what appears to be the Elk Lick Coal in a Baltimore and Ohio Railroad cut, 300 yards southward from Flatwoods Station, where a sample was collected for analysis and the following section measured by Gawthrop:

		Feet.
1.	Concealed	
2.	Fire clay and coal, Elk Lick (1185′ B.)	1
3.	Shale, greenish-gray	6
4.	Shale, reddish-brown	5
5.	Shale, gray, siliceous	5
6.	Sandstone to railroad grade	10

The composition of the sample from Nos. 3 and 4 only of the section, as reported by Messrs. Hite and Krak under No. 169G, is as follows:

	Per cent.
Silica (SiO_2)	54.45
Ferric Iron (Fe_2O_3)	10.19
Alumina (Al_2O_3)	19.67
Lime (CaO)	0.72
Magnesia (MgO)	1.66
Potassium (K_2O)	2.28
Sodium (Na_2O)	1.62
Titanium (TiO_2)	0.43

	Per cent.
Phosphoric Acid (P_2O_5)	0.38
Moisture	2.93
Loss on ignition	5.10
Total	99.43

The above results indicate a clay perhaps too high in the fusible components for the manufacture of ware possessing high refractory qualities, but it should make a good building brick, and, with care in burning, it would probably vitrify into brick having the desired qualities of durability for road and street paving purposes. The regions of the outcrop of this fire clay shale can be readily determined on Map II, since it belongs slightly below midway between the Pittsburgh and Bakerstown Coals, the detailed outcrops of which are shown on the same map. Its stratigraphic position at the point sampled is exhibited in the section given in Chapter IV for Flatwoods—0.5 Mile Southwest, page 92.

Upper Kittanning Fire Clay.—Seven to eight feet of plastic clay, 6 feet above one foot of flint clay, outcrops immediately below the Upper Kittanning Coal at the falls of the Little Kanawha River near Falls Mill, Braxton County, as exhibited in the section given in Chapter IV for the latter place, page 55. No sample for analysis was collected here, but, judging from its physical appearance and its character in Monongalia and Preston Counties, it probably possesses the right composition for the manufacture of fire brick, and especially so for building and paving brick. Its areal extent in this character appears to be local, since usually only a few feet —1 to 5—of impure fire clay shale intervene between the Upper Kittanning Coal and the great Upper East Lynn Sandstone in the southeast portion of each county.

ROAD MATERIAL.

RIVER AND CREEK GRAVEL.

In previous County Reports for the State Survey, the writer has called attention to the vast supply of gravel along the river and creek beds as a cheap and easily available supply of road-surfacing material. The highways usually follow closely along these streams, thus making it frequently possible to macadamize with this gravel at less cost than with stone quarried from the hillsides. Its durability is unquestioned, since it is not only largely derived in the territory of this Report from the more resistant ledges of the Conemaugh, Allegheny, and Pottsville Series across which the streams flow, but it has been worn down by attrition to a size suitable for direct application to the road surface, thus saving the usual expense of crushing, and when so placed is self-draining. It is specially recommended for roads not subjected to very heavy traffic.

LIMESTONE.

Limestone, possessing the desired hardness and durability for road macadam, may be considered negligible in Braxton and Clay, since the ledges represented largely consist of mere lenses or concretions, their chief value being the enrichment of the soil in the immediate region of their outcrop. The discussion of their utilization for this purpose is given on a subsequent page of this Chapter.

SANDSTONE.

The use of sandstone in crushed form for road surfacing or as concrete aggregate is general, especially the former for roads subjected to light traffic where other better materials are not so available. The many hard and siliceous ledges of the Conemaugh, Allegheny, and Pottsville Series, described fully in Chapters VI, VII, and VIII, respectively, should furnish an inexhaustible supply of such material.

BRICK.

The use of brick, manufactured from stratified clays and shales, for surfacing the improved highways of West Virginia and other States, has made great strides during the last decade, owing to its known durability and cheapness of maintenance when subjected to all forms of traffic, the greatest objection against it being the first cost. In this connection, the following table should prove of interest, in which the first cost per mile is based on roads already constructed in the State with a width of 14 feet, the data being furnished by A. D. Williams, State Road Engineer, and the variation in cost depending largely on the distance the material had to be transported:

Surfacing Material.	Cost per Lineal Mile.
Gravel	$ 500 to $ 3,000
Macadam	600 to 7,000
Concrete	7,450 to 16,500
Brick	15,000 to 21,000

In the territory of this Report, it is believed that material for the manufacture of a good paving brick, if properly burned, can be obtained from the sources described under "Clays and Absence of Development" at the beginning of this Chapter, thus resulting in a great reduction in cost on account of transportation charges.

BUILDING STONE.

In Chapters V to VIII, inclusive, the **sandstone quarries** have been described in detail under their respective geological horizons. The following table gives a list of these, arranged in the descending order of the ledges worked and classified by Series, along with page references to their descriptions:

Sandstone Quarries.

Name of Sandstone.	Page of this Report
In Monongahela Series:	
Cedarville Sandstone	177
In Conemaugh Series:	
Lower Pittsburgh Sandstone (6 quarries)	184-6
Connellsville Sandstone (3 quarries)	188-9
Morgantown Sandstone	193-4
Buffalo Sandstone	213
Upper Mahoning Sandstone (3 quarries)	217
Middle Mahoning Sandstone	222
Lower Mahoning Sandstone (2 quarries)	227
In Allegheny Series:	
Upper Freeport Sandstone	232-2
In Pottsville Series—Kanawha Group:	
Upper Winifrede Sandstone	260

AVAILABLE STONE.

As shown by the sections and descriptions given in Chapters IV to VIII, the sandstones in the counties in question range from flaggy and shaly beds, lacking the necessary cohesiveness to be used for building stone, to great massive, current-bedded and more or less quartzitic ledges, 20 to 100 feet in thickness, some of which will split into building blocks of any desired size. The massive ledges are all of the same general type, being usually micaceous, medium-grained to coarse-, gray on fresh fracture, but weathering to a grayish-brown, some of them being too soft, while others are hard and durable. The current-bedded and more or less quartzitic ledges, confined mostly to the Allegheny and Pottsville Series, are usually very hard, sometimes micaceous, highly siliceous to quartzitic, frequently pebbly, medium-grained to course-, grayish-white in color, and very durable, being specially adapted for rough stone work, such as coke ovens, bridge piers, foundations, retaining walls, mining buildings, and concrete aggregate, but as a general rule too irregular in bedding and texture for ornamental forms. Neither of the types have the beauty of texture and smoothness of grain to recommend them where ornamental or carved stone effects are needed, but in all buildings where durability and fire-proof construction are essential, the latter type can hardly be surpassed, special representatives of it being the Upper East Lynn, East Lynn, and Homewood Sandstones.

LIMESTONE.

The limestone beds of the Monongahela, Conemaugh, and Allegheny Series in Braxton and Clay, although thin, more or less lenticular, and scanty in their occurrence, have a considerable commercial value, since, in some localities, these appear to have attained sufficient purity and development to warrant their use for the manufacture of agricultural lime for strictly local consumption. The soils of the greater portion of the area are specially lacking in lime, a feature that has recently revived considerable interest among the native farmers as to their possible limestone resources. The available beds have been described in detail in Chapters V to VII, the following table giving a list of these, arranged in descending order and classified by Series, along with page references to their descriptions:

Name of Limestone	Page of this Report
In Monongahela Series:	
Sewickley Limestone	176
Redstone Limestone	179
In Conemaugh Series:	
Clarksburg Limestone	190
Orlando Limestone	194-5
Elk Lick Limestone	197-9
Ewing Limestone	206-9
Sutton Limestone	218-221
In Allegheny Series:	
Upper Freeport Limestone	230-1

The composition of the samples collected for analysis and referred to in Chapters VI and VII under the description of the beds themselves, pages 209, 220, and 231, respectively, as reported by Messrs. Hite and Krak, is given in the following table:

	899H.	886H.	887H.
	Ewing Limestone.	Sutton Limestone.	Upper Freeport Limestone.
Silica (SiO_2)	19.33	14.30	20.88
Ferric Iron (Fe_2O_3) and Alumina (Al_2O_3)	8.22	7.33	12.11
Calcium Carbonate ($CaCO_3$)	65.14	74.07	59.93
Magnesium Carbonate ($MgCO_3$)	1.78	0.80	2.72
Phosphoric Acid (P_2O_5)	1.48	0.61	0.41
Loss on ignition	2.02	1.99	3.21
Totals	97.97	99.10	99.26

The foregoing results show a rather high percentage of impurities—silica, ferric iron, and alumina—to obtain the best results for burning into agricultural lime, a feature that would probably cause the formation of many hard "clinkers" to be discarded. The economic use of these ledges for the purposes suggested, therefore, is largely problematical.

IRON ORE.

ATTEMPTS AT DEVELOPMENT.

An attempt was once made at Strange Creek, Braxton County, to develop the iron resources of the immediate region. Here, according to information furnished by George Goad of the latter place, James S. Savage of Jackson County, Ohio, promoted a company which completed a furnace on the east bank of Elk River, just above the mouth of Strange Creek, in 1876, and worked it spasmodically for a few years, its final abandonment being due to lack of ore and transportation facilities. The iron ore was obtained from thin scanty beds mostly of the "kidney" type in both the Conemaugh and Allegheny Series of the immediately surrounding region from scattered diggings wherever crop exposures could be found within a radius of 3 to 4 miles; and the limestone, to flux it, in the same locality from what appears to be the Ewing ledge, high up near the ridge summits on both hillsides of Elk River. The old calcine kiln is still standing but the furnace has disappeared. The resulting pig iron was shipped via Elk River on flatboats, constructed at this point, to Charleston, a distance of 75 to 80 miles.

AVAILABLE IRON ORE.

In the territory of this Report, the available iron ores, consisting of thin—6 to 18 inches—beds of the "kidney" type and lean carbonates, are mostly in the Conemaugh and Allegheny Series, and these, owing to their scanty occurrence and impure character, can not compete with the vast deposits of rich hematites in Minnesota and Michigan.

Ores of Conemaugh Series.

In the Conemaugh Series, there are two distinct ferriferous horizons that attain sufficient economic importance to warrant description. The first of these in descending order, consisting mostly of kidney ore from ½ to 6 inches in diameter and of beds ranging from 6 to 18 inches, belongs near the top of the Birmingham Shales, at 250 to 260 feet below the horizon of the Pittsburgh Coal and about 70 feet above that of the Harlem bed. The best development for it is in the northern border of Holly District, Braxton County, along the dividing ridge between the waters of Saltlick Creek and Elk River. The writer collected a sample of it for analysis at the road fork, 2.3 miles southeast of Flatwoods railway station and slightly less than ½ mile southeast of the Baltimore and Ohio Railroad tunnel, at an elevation of 1325′ B., where a mass of kidney nuggets are scattered through 2 to 3 feet of red shale. The composition of the sample, as reported by Messrs. Hite and Krak under No. 890H, is as follows:

	Per cent.
Silica (SiO_2)	23.69
Metallic Iron	46.63
Phosphorus	0.09
Manganese	0.19
Sulphur	0.03
Lime (CaO)	None

This bed of ore in practically the same development is exposed at outcrop along the ridge road, ¾ mile due east of Bulltown, in Braxton County, at elevations of 1235′ B. and 1260′ B.

The second ferriferous horizon of the two above mentioned for the Conemaugh belongs near the base of the latter Series, in the interval separating the Sutton Limestone and the Lower Mahoning Sandstone, this bed probably furnishing some of the ore used in the old furnace at Strange Creek. A fine exposure of it occurs along the Coal and Coke Railway grade, 1.4 miles southwest of the bridge over Elk at Gassaway, its thickness and stratigraphic position at this point being shown in a local section given in Chapter VI under the description of the Sutton Limestone in Otter District, page 219. The writer collected a sample of the ore here for analysis, the composition of which, as reported by Messrs. Hite and Krak under No. 891H, is as follows:

	Per cent.
Silica (SiO_2)	7.95
Metallic Iron	37.44
Phosphorus	0.32
Manganese	1.25
Sulphur	0.15
Lime (CaO)	2.85

Ores of the Allegheny Series.

In the Allegheny Series of the area in question, there appear to be two distinct ferriferous horizons, belonging respectively, at those for the Upper and Lower Freeport Limestones, and for that reason the same designation is given in Chapter VII for these ores, pages 230 and 234, respectively. The **Upper Freeport Iron Ore** does not seem very persistent and is thin, more or less impure, and of doubtful commercial value. The **Lower Freeport Iron Ore** appears on the other hand quite persistent, especially at its crop exposures in the southeast portions of Salt Lick and Holly Districts (Braxton), where it usually consists of hollow lenses of brown hematite, 6 to 10 inches in diameter. The writer collected a sample of it for analysis, the composition of which, as reported by Messrs. Hite and Krak under No. 889H, is as follows:

	Per cent.
Silica (SiO_2)	15.51
Metallic Iron	47.45
Phosphorus	0.33
Manganese	0.72
Sulphur	0.05
Lime (CaO)	trace

The three foregoing analyses of iron ore show a fair percentage of metallic iron, and when the rich ores of the Lake region of the United States begin to approach exhaustion, the scanty deposits of Braxton and Clay Counties should attract some attention.

SALT.

The manufacture of salt was once quite an important industry at Bulltown, Braxton County, in that it was the only source of supply for the natives of the immediately surrounding counties. According to information obtained by Gawthrop, a salt plant was established here by the Haymond family about the year 1795 and finally abandoned in 1868, the brine being obtained from wells drilled on the flood-plain of the Little Kanawha River in the immediate region. Two of these borings—listed as Nos. 11 and 12 on Map II—have already been described in Chapter X, pages 464-465. The Survey was unable to obtain the logs of any of these borings, so that the horizon of the salt water was not determined. More or less of the latter is encountered in almost every well sunk for oil and gas in either county, generally in what the drillers term the Salt Sand near the base of the Pennsylvanian, thus determining an inexhaustible supply of brine not only valuable for the manufacture of salt but also for the by-products, bromine and hydrochloric acid.

WATER-POWER.

AVAILABLE STREAMS.

No attempt on a large scale has ever been made to utilize the streams in the territory of this Report for the development of hydroelectric power, although there are many small water-wheel mills along the creeks to grind the grain of the immediate neighborhood. The most important streams for the development of such power on a commercial basis are the Little Kanawha and Elk Rivers, descriptions of which and the areas of their drainage basins being given in Chapter II, pages 19 and 19-20, respectively. No gaging records are available, but the run-off in the winter and spring months should be large, while that in the summer and fall, especially the latter, should be correspondingly small; hence, in any contemplated plan of development, the construction of large impounding reservoirs would have to be considered in order to equalize the flow at the power-plants. Again, the lack of convenient markets for such power, and the presence of large amounts of cheap natural gas and coal as competitive factors, render the success of such an operation at present problematical. On the Little Kanawha River, the most favorable point for the location of such a plant from the standpoint of non-interference with agriculture would be in the vicinity of Bulltown. The same would probably be true on Elk at Palmer, Glendon, and Dundon, at all of which points as also for Bulltown, the estimated hydroelectric power available is given in the tables on subsequent pages. Of course a serious drawback to the establishment of these plants now is the presence of considerable towns, railway lines, and valuable coal seams low down near the valley floors, the flooding of which would make the cost of condemnation prohibitive.

The four following tables, showing the indicated horsepower developed by the Little Kanawha and Elk Rivers and their large tributaries, are taken from pages 424, 425, 407, and 408, respectively, of the Semi-Centennial History of West Virginia, by Dr. J. M. Callahan, the tables in question being part of a special article on "Water-Power Resources" by A. H. Horton, District Engineer, Water Resources Branch, U. S. Geological Survey:

"Table No. 17.—Indicated Horse-Power Developed by Little Kanawha River.

Section of River.		Length. Mi.	Mean Drainage Area. Sq. mi.	Minimum Discharge. Sec. ft.	Assumed Discharge for Maximum Development—Sec. ft.	Total Fall. Ft.	Minimum Horse-power.	Assumed Maximum Development. Horse-power.
From	To							
Source	Below Right Fork	21	a98	16	76	1500	552	2,620
Below Right Fork	Bulltown	11	115	19	90	200	349	1,660
Bulltown	Above Tanner Creek	31	381	27	214	78	194	1,540
Below Tanner Creek	Upper level Dam No. 4	60	940	47	528	70	303	3,400
Upper level Dam No. 4	Mouth	32	1,700	85	970	40	313	3,570
Totals		155				1,888	1,711	12,790

a. Total Area

"Table No. 18.—Indicated Horse-Power Developed by Tributaries of Little Kanawha River.

Stream.	Section.		Length. Mi.	Mean Drainage Area.—Sq. mi.	Minimum Discharge. Sec. Ft.	Assumed Discharge for Maximum Development—Sec. Ft.	Total Fall. Ft.	Minimum Horse-power	Assumed Maximum Development. Horse-power.
	From	To							
Lick Creek	Source	Mouth	14	a53	8.8	41	400	81	377
Sand and Indian Forks	Source	Mouth	16	a68	11	53	500	127	610
Leading Creek	Source	Mouth	25	a128	21	99	500	242	1,140
Cedar Creek	Source	Mouth	32	a84	14	65	600	193	897
Left, Crooked, Right, and West Forks	Source	Mouth	30	a207	35	161	500	402	1,850
West Fork River	Source	Mouth	38	a242	40	189	600	552	2,610
Spring and Reedy Creeks	Source	Mouth	31	a262	42	204	500	483	2,340
Hughes River	Source	Smithville	28	a162	27	126	350	218	1,020
Hughes River	Smithville	Mouth	33	341	38	191	65	227	1,140
North Fork	Source	Mouth	50	a195	32	152	450	332	1,570
Goose Creek	Source	Mouth	23	a53	8.8	41	400	81	379
Totals								2,938	13,933

a. Total Area.

"Table No. 7.—Indicated Horse-Power Developed in Elk River.

Section of River.		Length. Mi.	Mean Drainage Area. Sq. mi.	Minimum Discharge. Sec. Ft.	Assumed Discharge for Maximum Development—Sec. Ft.	Total Fall. Ft.	Minimum Horse-power.	Assumed Maximum Development Horse-power.	Horse-Power Available from Storage for		
From	To								12 mos.	6 mos.	3 mos.
Source	Below Back Fork	40	[a]227	38	177	2,500	2,180	10,200	......	......	......
Below Back Fork	Above Holly River	25	282	47	220	550	2,380	11,100			
Below Holly River	Above Birch River	30	552	52	310	180	861	5,130			
Below Birch River	Above Buffalo Creek	25	832	55	467	[b]50	253	2,150			
Below Buffalo Creek	Mouth	51	1,280	60	729	150	828	10,100	19,000	38,000	76,000
Totals		171				3,430	6,502	38,680	19,000	38,000	76,000

a. Total Area.

b. Fall reduced about 25 ft. by proposed Elk River reservoir.

"Table No. 8.—Indicated Horse-Power Developed by Tributaries of Elk River.

Stream.	Section.		Length. Mi.	Total Drainage Area, Sq. Mi.	Minimum Discharge Sec. Ft.	Assumed Discharge for Maximum Development—Sec. Ft.	Total Fall. Ft.	Minimum Horse-Power.	Assumed Maximum Development. Horse-Power.
	From	To							
Holly River	Source	Mouth	25	153	26	120	2,000	1,200	5,520
Birch River	Source	Mouth	32	139	23	108	2,000	1,060	4,960
Buffalo Creek	Source	Mouth	21	113	19	88	1,400	611	2,830
Big Sandy Creek	Source	Mouth	32	101	17	79	410	160	745
Blue Creek	Source	Mouth	23	58	10	45	280	64	1,100
Little Sandy Creek	Source	Mouth	22	67	11	52	920	232	290
Totals	......	......	......	......	......	......	......	3,327	15,445

FORESTS.

BRAXTON COUNTY.

A very complete description of the forests of the State by Counties is given by A. B. Brooks in Chapter VI, Volume V, of the West Virginia Geological Survey Reports, published in 1911, the details of which, pertinent to Braxton County, pages 116-119, as relating to the original and present forest conditions, are republished here as follows:

"Original Timber Conditions.

"According to an early writer on the timber resources of the State, 'All the varieties (of timber) common to the altitude and latitude of the county (Braxton) are found. Poplar and the various kinds of oak are the most plentiful, though there is an abundance of hickory, ash, maple and some walnut. The poplar of this county is remarkably fine, the rich soil having produced a very large growth and the trees reach enormous proportions. The oak timber is also very fine and in much demand.'

"Pitch pine grew in most sections on dry hills and hemlocks were commonly found thinly scattered along streams. J. I. Bender, of Burnsville, reports small areas of white pine near Chapel Post-Office on Steer Creek, and a scattered growth of red cedar on Cedar Creek and at the falls of the Little Kanawha.

"The Lumber Industry.

"The Elk and the Little Kanawha Rivers were the principal outlets for the timber of Braxton County before the building of the Baltimore and Ohio and the Coal and Coke Railroads. As early as 1846, and perhaps several years earlier, there were many persons employed along Elk River in constructing flatboats. These boats which were often 18 or 20 feet wide and from 75 to 120 feet long were largely made of yellow poplar. Many of the finest poplar trees growing close by, or within easy reach of the river were cut down, squared, pitted, and sawed in two with whip saws for flatboat gunwales. At the date mentioned above, and for several years thereafter, these boats were loaded with split staves and taken to the salt furnaces in the Great Kanawha Valley. There the staves were sold to coopers who manufactured salt barrels, and the flatboats were sold to salt producers for the transportation down the river of the large quantities of salt then being produced in that region. The boats usually sold at $1 for each running foot. Some of the first timber to go out from the county was floated and rafted on the Elk and Little Kanawha Rivers. This industry was carried on at first principally by the farmers or the owners of small boundaries of woodland and not by companies as in some other sections. The principal timbers rafted were poplar and black walnut. In later years lumber companies with mills at Charleston, Parkersburg, and other points bought stumpage high up on the Elk and the Little Kanawha and rafted out their logs.

"One of the pioneer mills of central West Virginia was located at or near Bulltown on the Little Kanawha. It is probable that this mill was in operation more than a hundred years ago. Several primitive water sawmills were in operation 60 years ago along the larger streams. Two of these were Peeble's mill at the mouth of Holly River and Frame's mill at Frametown on the Elk. When the Richwood Branch of the B. & O. Railroad was built through the county and a branch extended to Sutton in 1892, a lively lumber industry was begun by portable sawmills and by larger stationary mills in the interior forests. Prior to the building of these roads there had been little sawing except by water-power mills.

"Pardee and Curtin Lumber Company operated a band mill at Sutton from about 1892 to 1905. The logs for the mill were largely obtained in Holly District of Braxton and in Webster County.

"T. M. Mitchell began to operate a circular mill on Wolf Creek in 1895 and cut a large quantity of good timber from the H. L. Robinson tract of 2,240 acres. Later the Mead and Speer Company operated a circular mill of the same tract cutting the largest remaining timber. The latter company ceased its operations on this tract in 1902. The West Virginia Pulp and Paper Company cut the pulp timber from an adjoining tract of 2,250 acres, beginning about the year 1898.

"The Braxton Coal and Lumber Company established a band mill at Gillespie on Elk River in 1894 and operated it for 3 years.

"The Holly Lumber Company had a band mill at Palmer from about 1895 to 1900. Most of the timber sawed by this company was from Webster County.

"John Paulhamus and Son operated a band sawmill at Centralia and cut timber from a tract of 13,000 acres in Braxton and Webster. Their operation continued from about 1900 to 1906.

"Smith Brothers were extensive operators of portable sawmills on Elk and Little Kanawha divide between 1903 and 1907.

"From about 1894 to 1900 Henry Waggy with portable mills cut timber on a 12,000-acre tract on the head of Birch River in Braxton and Webster. His lumber was hauled on a tram road to the Baltimore and Ohio Railroad.

"J. H. Chapman and Peter Goble purchased 2,000 acres of timber land on Grannys Creek near Sutton about the year 1894, and cut the timber from it with a circular mill located at Karl Siding. Their operations continued for about 3 years.

"The Interstate Cooperage Company has been operating from 1 to 5 stave mills in the Braxton County part of their large forest lands since 1906. The sawed stave industry in Braxton began with the operations of this company.

"The Meed and Speer Company has been running a band mill at Jennings on Strange Creek since 1904.

"A score or more of portable sawmills are sawing irregularly throughout the county at the present time.

"Present Forest Conditions.

Braxton County still has a few acres of virgin forest. These are located principally between the Elk River and the Gilmer and Calhoun Line several miles west of Sutton. Their combined area is about 9,670 acres. The 24,000 acres of cut-over forest land is located on both sides of the Elk and Holly Rivers near the Webster Line, on Strange Creek and Birch River in the southern end, and about 5,000 acres adjoining the virgin areas above referred to.

"The remainder of the county is divided up into small farms most of which contain only sufficient timber for ordinary domestic purposes."

Areas Suitable for Reforestation.

The utility of forests and the immeasurable benefits derived from the application of a systematic plan of reforestation are well stated by Mr. Brooks on pages 17-47 of Volume V, quoted above. A large part of Braxton County, especially the northwest half, is so well adapted to agriculture and grazing that it is problematical whether much of it will ever be reforested, this being true over the greater portion of the areal extent of the Monongahela and Conemaugh Series, the detailed outcrops of which are shown on Map II. The area most suited for this purpose is the rough stony land and steep hillsides of the Allegheny and Pottsville Measures, these being of the least value for tillage or grazing.

CLAY COUNTY.

In the volume last mentioned, on pages 128-132, Mr. Brooks also described the forest and timber conditions of Clay County, the portions of which relating thereto are republished here as follows:

"Former and Present Forest Conditions.

"The former forest conditions in the county can be known by a study of the virgin areas yet remaining. A representative boundary of 15,000 acres was found to contain, approximately, 100 million feet, board measure, of the following species of timber:

	Per cent.
"Oak,—principally White Oak—	40
Poplar	20
Beech	10
Hickory	5
Hemlock	5
Maples	5
Basswood	3
Cucumber	2
White Ash	2
Birch	2
Chestnut	3
Black Walnut	3
Black Gum	
Locust	
Buckeye, and others	

"The only parts of the county which have not produced good timber in great abundance are the thin and rocky southern exposures and the steep bluffs along the river and creeks. Hardwoods of various kinds predominate, the only softwood of much value being hemlock. This grows, principally, along the narrow bottoms and steep hillsides facing the larger streams. Pitch pine is found sparsely scattered over the county on dry ridges and high up on the river bluffs. A few red cedar trees grow along the river banks in the southern end of the county. Of other less valuable species, not mentioned here nor in the list above, there are the sycamore. white elm, river birch and the rare sweet gum, growing along the river, and smaller quantities of white walnut, black cherry, honey locust, slippery elm and others, scattered throughout the county. The timber on the virgin forest areas would estimate from 5,000 to 8,000 feet per acre, of the species listed above. That on the cut-over areas would estimate, on the average, about 1,000 feet per acre of such species as oak, beech, hickory, birch and buckeye. The farmer's woodlots, as a rule, are cut over but contain sufficient timber for domestic purposes. The approximate total stand of all kinds of timber in the county, including the less valuable species of cut-over and woodlot areas, is 250 million feet.

"Virgin, Cut-over and Farm Areas.

"An investigation of conditions in the county has given us the following classification of forest and farm land:

"Virgin forest land..............................	17,500 acres
Cut-over forest land............................	75,000 acres
Farm and woodlot land........................	130,220 acres

"The principal boundary of virgin timber yet remaining is toward the head of Buffalo Creek, being part of a tract which extends into Nicholas County. There are about 2,000 acres of virgin timber in the extreme southwestern part of the county, and 1 or 2 small tracts yet remaining in Otter District, west of Elk River. The cut-over areas lie, principally, east and southeast of the Elk River and are greatly in excess of either the uncut forest or the farm lands in that section. On the west side, although not more than 25 per cent. of the land has been cleared for cultivation, the woodland is largely owned by the farmers. The most improved lands of the county are on Porters Creek, Right Fork of Big Sycamore, and on the heads of O'Brien, Big Sandy and Big Otter Creeks.

"The Early Lumber Industry.

"For the past 75 years, or more, the Elk River, which furnishes excellent rafting facilities, has carried many millions of feet of logs, lumber, cross-ties and staves from its adjacent forest lands in Clay, Braxton and Webster Counties. Active rafting in Clay County did not begin, however, until about the close of the Civil War. The Charleston, Clendenin and Sutton Railroad (now Coal and Coke Railroad) reached the town of Clay in December, 1895, and was extended to Ivydale, 12 miles above, in 1900. During the 30 years which preceded the coming of the railroad, the best timber had been stripped from all the land in the county fronting on the Elk River and the large creeks. In fact, the poplar had been cut for as many as 10 or

12 miles up the larger creeks and drifted out. All of the available walnut, also, went out from 1880 to 1885. The men who were in the rafting business, especially during the early years of that industry, took only the best of the most valuable species. This left considerable good timber on the easily accessible areas to be taken, with the large quantities on the more remote virgin lands, by the sawmills which became numerous after the building of the railroad. Before that time the few small circular mills which had found their way into the county and a water-power mill located at Serena on Big Sycamore Creek, manufactured lumber in considerable quantities. The largest amounts cut during this period were by Samuel Stephenson, 1885-1895, who operated on Big and Little Sycamore Creeks and elsewhere; the Chaney Lumber Company, 1890-1895, which cut over 10,000 acres on the head of Blue Creek; John T. Moore, 1890-1898, who sawed at Clay Court-House, on Camp Creek, Big Laurel Creek, and at other points.

"Later Lumber Operations.

"The first large mill to be located in the county was erected at Porter in 1895. This mill has cut the timber from about 20,000 acres, E. L. Boggs has been operating a circular mill for the past 15 years in Otter District and has cut over about 5,000 acres. M. Hardman and Company purchased 5,000 acres on Standingrock Run and other streams and removed the timber from the same during the years 1895 to 1900. The logs cut by this Company were splashed from the small streams into Elk River where they were rafted and run to Charleston. W. S. Lewis operated a stave and lumber sawmill from 1896 on Big Laurel, Big Otter and head of Big Sandy Creeks, cutting over about 15,000 acres of virgin timber. C. L. Ritter Lumber Company began operating in 1899 and cut over about 26,000 acres in the 10 years following. The David S. Collins Company began operating at Elkhurst in 1899 and cut the timber on 10,000 acres. This company was succeeded by Elkhurst Planing Mill Company which completed the cutting on an additional 5,000-acre tract in 1906. Tidewater Oil Company operated on Big Otter Creek from 1900 to 1906, cutting the timber from 28,000 acres. The Leatherwood Lumber Company began operating on Leatherwood Creek in 1900 and cut the timber from a 1,300-acre tract of land owned by the Jacob Tome Institute and C. C. Lewis. Waggy and Gorrel have been cutting on Whetstone, Little Laurel and Spread Shoal Creeks since 1900, taking the timber from about 5,000 acres. Mitchell and Good commenced operating about 1904 and have cut the timber from 3,000 acres of land drained by O'Brien Creek. Shadle and Auchmuty began at Yankee Dam in 1906 and are engaged in removing the timber from 2,000 acres on Elk River and Blue Knob Creek. Crescent Lumber Company has been in operation since 1907 and is engaged in cutting timber from a 10,000-acre tract. Of those who have manufactured staves in the county we may mention D. G. Courtney who operated stave mills on Buffalo Creek from 1904 to 1908, recutting about 10,000 acres which had been cut over, originally, by The C. L. Ritter Lumber Company, and Tidewater Oil Company, which, also, has manufactured large numbers of staves in the county.

"The cross-tie and stave industries have been carried on for the past 25 years and millions have been floated and shipped out.

"The only large industry, practically, which has existed in Clay County—outside of farming—has been the lumber industry in its various phases.

"By reference to the list of sawmills given in another part of this

report it may be seen that there are 3 band mills and 16 circular mills in operation now in Clay County. These are reducing the stand of timber at the rate of about 50 million feet annually.

"Forest fires, originating from hunters, ginseng diggers, and the railroads, are of frequent occurrence throughout the dry months and burnt areas of considerable extent are becoming overgrown with sassafras, grape vines and other undesirable species of trees and shrubs.

"In the judgment of those best acquainted with conditions in the county not less than 50 per cent. of the land is absolutely unfit for agricultural purposes."

Areas Suitable for Reforestation.

In Clay County, as shown by the above data, practically half of the land is unfit for agricultural purposes, so that there is a large acreage available on which reforestation could be carried on with profit to all concerned. By far the greater portion of this region lies southeast of Elk River and along the valley walls of the latter stream, the outcropping rocks being those of the Allegheny and Pottsville Series and the basal 100 to 200 feet of the Conemaugh. In this portion of the County a considerable part of the land is owned in large blocks by coal and lumber companies, a feature that should simplify the problem of reforestation, in that a plan of co-operation could be more readily established in the employment of a force of forest rangers, the expense being assessed on the companies proportional to the number of acres owned. The rangers could not only look after the protection of young timber from fires, but also the planting of young trees and direct the cutting of the mature timber.

PART IV.

Paleontology.

CHAPTER XII.

NOTES ON THE PALEONTOLOGY OF BRAXTON AND CLAY COUNTIES.

WINIFREDE LIMESTONE FOSSILS AT PALMER.

By W. Armstrong Price.

Accompanied by Mr. C. F. Wells, the writer visited Palmer, in Braxton County, for the purpose of collecting fossils from an outcrop of the Winifrede Limestone member of the Kanawha Group of the Pottsville Series. Mr. Ray V. Hennen, who discovered the exposure at Palmer, 150 feet west of the West Virginia Midland Railway station, measured the following hand-level section at this point:

Section at Palmer.

	Thickness. Feet.	Total. Feet.
Pottsville Series:		
Kanawha Group:		
1. Sandstone, Homewood, grayish-white, medium-grained, making cliffs	100	100
2. Concealed	33	133
3. Shale, sandy, buff	7	140
4. Shale, dark, plant fossils, Kanawha Black Flint horizon (no marine fossils seen here, but in same general area are found at many places)	1.5	141.5
5. Stockton Coal.... Coal, gas....0' 6" Coal, slaty...1 4 Coal, medium-hard.......1 8	3.5	145
6. Shale and concealed	70	215
7. Sandstone	5	220

		Thickness. Feet.	Total. Feet.
8.	Shale, sandy	14	234
9.	**Shale, black; marine fossils abundant, Winifrede Limestone horizon** (limestone bearing fossils seen ½ mile east of Palmer)	6	240
10.	Shale, sandy, blue-gray	4.3	244.3
11.	Coal, Chilton	0.7	245
12.	Shale	2	247
13.	Sandstone, to West Virginia Midland Railway grade at Palmer	13	260
14.	Concealed to bed of Elk River	25	285

Other fossiliferous strata outcropping in Braxton and Clay Counties are shown in the following section adapted from the generalized stratigraphic section for the two counties prepared by Hennen:

Table of the Fossiliferous Strata of Braxton and Clay Counties.

		Thickness. Feet.	Total. Feet.
Permian System.			
1.	Dunkard Series, a little less than	300	300
Pennsylvanian System.			
2.	Monongahela Series (400')	400	700
	Conemaugh Series (635'):		
3.	Interval below Pittsburgh Coal	354	1054
4.	**Ames Limestone horizon**; shale, dark, green, argillaceous, bearing marine fossils in abundance	5	1059
5.	Interval	155	1214
6.	**Brush Creek Limestone horizon**; shale, bearing plant and marine fossils	5	1219
7.	Interval to top of Upper Freeport Coal	116	1335
8.	Allegheny Series (350')	350	1685
	Pottsville Series (1280'):		
9.	Homewood Sandstone	100	1785
10.	Interval	35	1820
11.	**Kanawha Black Flint**, bluish-black, ranging from hard, siliceous shale to flint; marine fossils often abundant	5	1825
12.	Interval	225	2050
13.	**Winifrede Limestone**, yellowish-gray, lenticular, often replaced by dark shales carrying marine fossils in abundance	5	2055
14.	Interval	180	2235
15.	**Campbell Creek Limestone horizon**; shale, dark; **Lingula**	15	2250
16.	Interval	225	2475
17.	**Eagle Limestone horizon**; shale, black, sandy, lenses of limestone; **Lingula**	15	2490
18.	Shale and sandstone alternating	40	2530
19.	New River Group (425')	425	2965
Mississippian System.			
	Mauch Chunk Series.		

No systematic investigation of the fossils of the area has been undertaken, although their presence has been noted at many places by Hennen. A list of localities in Braxton County from which fossils were collected by the writer and Mr. D. B. Reger in connection with the survey of Lewis and Gilmer Counties has been published,[1] but the collections have not been studied.

On examining the exposure of the black shale No. 9 in the Palmer section,[2] marine invertebrate fossils were found to be abundant chiefly in the lower 2 inches of the bed. Above this through a thickness of about 3 feet fossils were found in less profusion (chiefly *Chonetes granulifer* and *Naiadites elongata*) and were almost entirely absent in the upper portion of the unit.

The following species have been recognized:

Enchostoma sp. cf E. sp. Girty[3].
Chaetopod jaw.
Crinoidea, columns and spines, abundant.
Lingula kanawhensis Price.
Orbiculoidea missouriensis (Shumard).
Orbiculoidea capuliformis (McChesney), common.
Derbya robusta (Hall), very abundant.
Chonetes granulifer Owen, very abundant.
Pustula symmetrica (McChesney), abundant.
Marginifera wabashensis (Norwood and Pratten), abundant.
Spirifer boonensis Swallow ?, abundant.
Spiriferina kentuckyensis (Shumard) abundant.
Composita subtilita (Hall), abundant.
Solenomya radiata Meek and Worthen?
Naidites elongata Dawson.
Deltopecten sp.
Pectenoida indeterminata.
Allerisma guyandotensis Price.
Cypricardinia ? carbonaria Meek ?
Ostracoda indeterminata, common.

Description of the species examined is postponed for inclusion in a later publication.

The purpose of the investigation was chiefly to determine, if possible, on paleontologic grounds whether the fauna is more closely related to that of the Winifrede Limestone or to that of the

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[1] West Virginia Geological Survey, Report on Lewis and Gilmer Counties, 1916, pp. 628-9 (Localities Nos. 94, 95, 96, 97, 132, 134, 136 and 138).

[2] Locality No. 139.

[3] *Enchostoma* sp. Girty, 1915, U. S. Geol. Survey, Bull. 544, p. 39, pl. v, fig. 6.

Kanawha Black Flint. As neither of these faunas has been studied over a large area, the task is not very definite, nor susceptible of satisfactory solution with the data in hand. Of the brachiopoda of the collection an equal number are common to the Winifrede Limestone and to the Flint. *Enchostoma sp.* seems to be the same as a form previously noted in the Flint, and *Derbya crassa* is likewise found in this collection, and is, so far, elsewhere in West Virginia known only in the Black Flint. *Spiriferina kentuckyensis* is known only in the Winifrede and Eagle Limestones. Of the 10 brachiopoda found in the collection, 8 have likewise been found in the Eagle Limestone, 7 in the Kanawha Black Flint, 7 in the Winifrede Limestone, 5 in the Seth Limestone, 5 in the Buffalo Creek Limestone, and 4 in the Dingess Limestone. It can not be safely said that the fauna of this collection excludes the correlation of the fossiliferous bed No. 9 of Hennen's section with any of the abundantly fossiliferous horizons of the Pottsville.

THE UFFINGTON SHALE OF NORTHERN WEST VIRGINIA—ABSENCE OF MARINE FAUNA.

By W. Armstrong Price.

The Uffington Shale of I. C. White[1] constitutes, when present, the basal member of the Conemaugh formation in Monongalia and other counties of northern West Virginia.[2] It was named from the village of Uffington, situated on the Monongahela River one and one-half miles south of the corporate limits of Morgantown, at the mouth of Booths Creek, and was described by Dr. White as follows[1]:

> "The interval which separates the Lower Mahoning sandstone from the Upper Freeport coal varies greatly both in thickness and character. Frequently a massive, and usually bluish-gray, sandstone rests directly upon the underlying coal without any intervening shales whatever. At other times a dark, sandy, fossiliferous shale, twenty to forty feet thick, will intervene for short distances, to be entirely displaced by massive sandstones within a few hundred feet, mostly by erosion, which took place during the period of deposition of the sandstone. ***These shales*** contain marine fossils as well as many plant remains, and it is from this horizon, and mostly from the Uffington locality, that Dr. John J. Stevenson collected the specimens identified by Mr. Meek, and published in the Third Annual Report of the Board of Regents of the West Virginia University for the year 1870."

No list of plant fossils from this horizon has been published, though their presence has been noted at various points[3].

The following marine invertebrate fossils, collected by Stevenson and identified by F. B. Meek, were reported by White, as noted above:

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[1] I. C. White, West Virginia Geological Survey, Vol. II, 1903, p. 323.

[2] Ray V. Hennen and D. B. Reger, West Virginia Geological Survey, Report on Preston County, 1914, p. 149.

D. B. Reger, West Virginia Geological Survey, Report on Lewis and Gilmer Counties, 1916, pp. 132 and 159.

[3] Ray V. Hennen, West Virginia Geological Survey, Report on Monongalia, Marion and Taylor Counties, 1913, pp. 305, 321, 322. See also foot-notes 1 and 2.

List of Fossils in Roof Shales of the Upper Freeport Coal, near Morgantown, Monongalia County, West Virginia.

(*New species).

Crinoidal columns.
Erisocrinus. Undetermined species.
Aviculopecten carbonarius Stevenson sp.
Pecten broadheadi Swallow.
Pecten hawni Geinitz.
Allorisma. Undetermined species.
Nucula ventricosa Hall.
*Nucula anodontoides Meek.
Nuculana bellistriata Stevenson sp. A very small attenuated variety.
*Yoldia carbonaria Meek.
*Yoldia stevensoni Meek.
Schizodus. Undetermined species.
Edmondia aspenwallensis Meek.
Astartella. Undetermined species.
Macrocheilus primigenius Conrad.
Macrocheilus ventricosus Hall.
Macrocheilus. Undetermined species.
Polyphemopsis peracutus Meek and Worthen.
Euomphalus rugosus Hall.
Bellerophon montfortianus Norwood and Pratten.
Bellerophon percarinatus Conrad.
Bellerophon carbonarius Cox.
Bellerophon meekiana Swallow.
Pleurotomaria grayvillensis Norwood and Pratten.
Othoceras cribrosum Geinitz.
Nautilus occidentalis Swallow.
Phillipsia sangamonensis Meek and Worthen.
Productus nebrascensis Owen.
Productus prattenanus Norwood.
Athyris subtilita Hall. Very abundant and presenting all the usual varieties.
Productus. Species undetermined. Very small, concentrically wrinkled.
Spirifer (Martinia) planoconvexus Shumard.
Spirifer cameratus Morton.
Aviculopecten. Undetermined species. Probably A. occidentalis Shumard.
Hemipronites crassus Meek and Hayden.

Other citations of marine fossils at this horizon are confined to the writings of Stevenson, who reports them at two additional localities shortly to be discussed, and to a report by Ray V. Hennen[4], who repeated I. C. White's statements made in his first description of the formation with Meek's list of fossils. Hennen did not himself observe fossils in the shales[5].

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[4] West Virginia Geological Survey, Report on Monongalia, Marion and Taylor Counties, 1913, p. 321.

[5] Oral communication.

In 1906, in his "Carboniferous of the Appalachian Basin,"[6] Stevenson for the first time uses the name "Uffington Shale" as the equivalent of the "dark shale just below the Mahoning sandstone" from which he, in his earlier report, quoted above by White[7], states he collected the fossils identified by Meek. In addition to the Monongalia County occurrences "on Deckers and Booths Creeks"[8] he reports fossils in the Uffington Shale "eight or ten miles north of Burning Springs" (Wirt County, West Virginia)[9].

A portion of his section measured at this point is as follows:

		Feet.
5.	Sandstone, shaly to massive	65
6.	Chert	5-12
7.	Shale with nodular limestone	9
8.	Black shale	3
10.	Coal bed, Upper Freeport	1
11.	Shale and sandstone	120

In this section appears a chert bed, Number 6, five to twelve feet in thickness, separated from the fossiliferous black shale, Number 8, below, by nine feet of shale with nodular limestone. No Number 9 appears in the section as given by Stevenson. Hennen, describing the Brush Creek Limestone or "Hughes River Flint" in the region from which Stevenson's section was obtained, says[10]:

> "Along the crest of the Burning Springs arch of Northern Wirt this limestone appears to have been replaced by a reddish-gray and white ledge of chert or flint, ranging in thickness from 5 to 15 feet, coming 200 feet below the fossiliferous Ames limestone, or the interval as at its type locality in Pennsylvania."

Moreover, the Brush Creek Coal of this region has a uniform thickness, as shown in the published sections, of one foot, which is the thickness given by Stevenson for his "Upper Freeport" Coal. A portion of Hennen's section measured at Borland, eight miles north of the northern extremity of Wirt County[11], is given for comparison with Stevenson's section:

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[6] J. J. Stevenson, Geol. Soc. America, Bull., Vol. 17, 1906, p. 132, (whole volume, p. 324), see also pp. 136 (328), 149, (341), and 161, (353).

[7] J. J. Stevenson, West Virginia University, Regent's Rept., 1871, for 1870, pp. 50, 72 and 73.

[8] Geol. Soc. America, Bull., Vol. 17, 1906, p. 132 (whole volume, p. 324).

[9] Idem, p. 149 (341).

[10] Ray V. Hennen, West Virginia Geological Survey, Report on Wirt, Roane and Calhoun Counties, 1911, p. 258.

		Feet.
3.	Sandstone, massive, Buffalo	40
4.	Limestone, flinty, fossil shells, black, Brush Creek	2
5.	Black shale, fossil shells	15
6.	Coal, Brush Creek	1
7.	Fire clay and dark shale	5
8.	Concealed	15
9.	Sandstone, massive, Mahoning	15
10.	Coal, good.........2′ 7″ Slate, gray.........0 1¾ Coal, good.........0 8 Upper Freeport	3.4

From the similarity of the two sections with their coals, fossiliferous shales, and flint beds, the inference is that the "Uffington" fauna is here Brush Creek. Did we know more precisely the locality of Stevenson's section, more definite proof might be advanced[11a]. As this is the only flint bed known in the region there is little possibility of error in the correlation here proposed.

At one other locality, at Cutright in Upshur County, on Buckhannon River between Buckhannon and Sago, Stevenson reported a marine fauna which he also correlated with the Uffington[12]. This bed has recently been determined by D. B. Reger[13], after making detailed surveys of Upshur and adjoining counties, to be the Brush Creek Limestone. This limestone is exposed on Buckhannon River along the Baltimore and Ohio Railroad grade one-fourth mile north of the mouth of Cutright Run and was described in a section by I. C. White[14], whose correlation is confirmed by Reger. Neither of these observers found a marine Uffington Shale in this region.

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[11] Idem, p. 259. (Fossils were collected here in December, 1911, by J. W. Beede and D. B. Reger, according to a verbal statement by the latter.

[11a] Fossils were collected from the Brush Creek limestone on Flint Run, in Wirt County, 10 miles north of Burning Springs, by J. W. Beede and D. B. Reger, and it may be that this is the locality at which Stevenson reported fossils, (Oral communication from Mr. Reger).

[12] Geol. Soc. America, Bull., Vol. 17, 1906, pp. 135-6 (327-8 of whole volume).

[13] West Virginia Geological Survey, Report on Barbour, Upshur and Randolph Counties, Chap. IV, in press.

[14] West Virginia Geological Survey, Vol. II, 1903, p. 279.

Stevenson finally sums up his observations on the Uffington Shale as follows[15]:

> "Underlying the Mahoning and separating it from the Upper Freeport coal bed is a shale, the Uffington shale of I. C. White. It is not persistent, having been removed from wide areas during deposit of the overlying sandstone. Near Morgantown, in northern West Virginia, it is crowded with marine forms which are abundant even at contact with the coal; elsewhere except in Upshur and Wirt Counties the fauna seems to be wanting, but the shales have yielded many plant remains."

Having seen that the Upshur and Wirt fossils are Brush Creek, according to surveys later and more detailed than Stevenson's investigations, we have left for consideration only the Monongalia County localities; namely, on Booths Creek at the type locality of the Uffington and on Deckers Creek.

In an attempt to discover the fauna in the region immediately adjacent to the type locality, the writer, accompanied by Mr. C. F. Wells, examined the outcrops of the Upper Freeport Coal and the Uffington Shale on the west bank of the Monongahela River. Beginning at Uffington, where, in going southward from Morgantown, these beds first appear above drainage, careful search was made as far south as Lock Number 12 near Little Falls, a distance of five miles. Nowhere were marine fossils seen. The shale between the coal and the Mahoning Sandstone was found to be either sandy and barren or plant-bearing, highly argillaceous, greasy in feel and lacking a fissile structure[16].

Assisted by Mr. E. J. Kersting, the writer measured the following hand-level section in the village of Uffington on the south side of Booths Creek at its mouth, beginning 3 feet and 10 inches below the level of the county road, and ascending the bluff[17]:

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[15] Geol. Soc. America, Bull., Vol. 17, 1906, p. 161 (whole volume, p. 353).

[16] From Prof. S. B. Brown, of West Virginia University, it has been learned that he, in company with David White, in 1902, collected plant fossils from this formation at Uffington but did not discover animal fossils. On various other occasions Prof. Brown has examined the shales in the endeavor to find marine fossils but without success.

[17] See also Ray V. Hennen, West Virginia Geological Survey, Report on Monongalia, Marion and Taylor Counties, p. 305, section measured 0.3 mile south of this point.

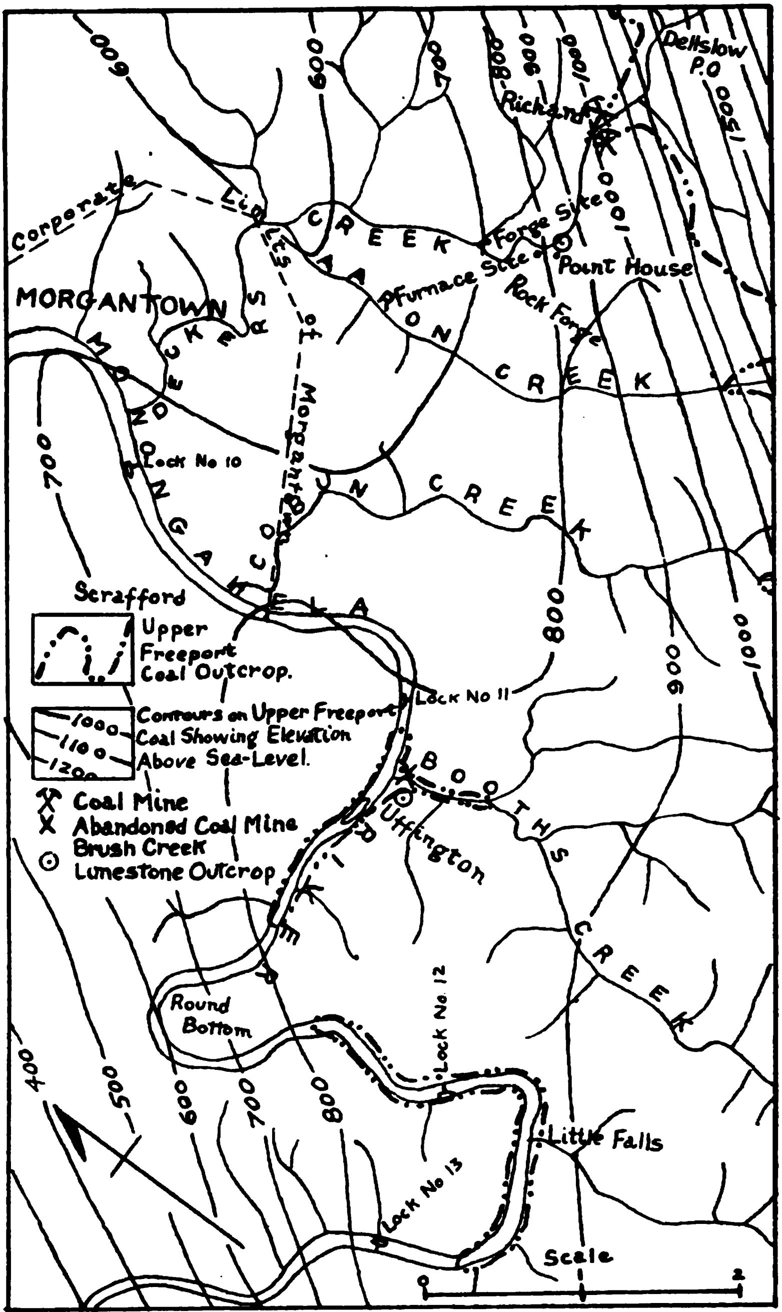

Figure 16.—Map of Morgantown and Vicinity, showing Upper Freeport Coal outcrop and Stevenson's fossil localities.

Section at Uffington.

			Thickness.		Total.	
			Ft.	In.	Ft.	In.
1.	Coal, Upper Freeport	Coal, reported 8 inches thick..0' 2 " Shale, black; casts of plant roots .... 0 2½ Coal 1 8½	2	1	2	1
2.	Shale, Uffington	Shale, dark, sandy, with interstratified sandstone; limestone nodules and plant fossils .... 4 6 Sandstone, thin-bedded, with shaly laminae, and plant fossils .... 8 0 Shale, dark, argillaceous; greasy in feel, with layers of large oölitic limestone and hematite nodules; plant fossils in middle and upper portions 17 6	30	0	32	1
3.	Sandstone and shale in interstratified lenses		5	5	37	6
	Erosional Contact.					
4.	Sandstone, Mahoning, light-colored, fine-grained, conglomeratic; in basal portion containing pebbles and small lenses of the underlying shale; readily disintegrating by removal of the cement of the sand grains, forming irregular cavities in the rock, the leaching of the cement resulting in the deposition of crusts of magnesium sulphate on surfaces of the stone exposed to the atmosphere...		34	0	71	6
5.	Clay-shales, gray, red (from weathering) and yellow....................		20	0	91	6
6.	Coal, Brush Creek, bony................		0	6	92	0
7.	Shale, Brush Creek limestone horizon, with ferriferous nodules and abundant marine fossils................		3	0	95	0
8.	Concealed, in floor of sandstone quarry		3	0	98	0

		Thickness. Ft.	Thickness. In.	Total. Ft.	Total. In.
9.	Sandstone, Buffalo, light-colored, hard; formerly quarried..................	16	6	114	6
10.	Sand and gravel, Quaternary alluvium, lying upon river terrace, largely removed in sand pits, with aboriginal human remains reported as found at top; total thickness unknown; visible	10	0	124	6

Diligent search again failed to reveal marine fossils in the Uffington Shale. The shale itself possesses none of the general appearance of marine shales of the Conemaugh and is abundantly filled with plant fossils which are too perfectly preserved in outline and surface structures to admit of the supposition that they were carried into a basin of marine deposition. On the other hand, the shale of the Brush Creek horizon is filled with the casts of marine shells, several of the species given by Stevenson and Meek in the list quoted above being noted by the writer in a preliminary examination of the fossiliferous shale in the field. This shale is dark, carbonaceous and without plant remains, so far as the field examination showed.

It is the belief of the writer that Stevenson's fossils, collected at Uffington, were from this bed and not from the Uffington Shale of I. C. White, for, as will appear from the quotations to follow, Stevenson, at the time he reported the collection of the fossils and their identification by Meek, plainly stated that he correlated the coal now generally known in this region as Upper Freeport with the "Kittanning seam." It follows from this that the "dark shale underlying the Mahoning Sandstone" from which Stevenson reported the marine fossils is not the bed now known as the Uffington Shale[18].

According to Stevenson's description, above the "Kittanning" Coal lies 10 feet of "black, very bituminous" shale, burning easily and often worked with the underlying coal. White describes a similar feature in some sections of the Upper Freeport Coal of Monongalia County[19]. Above this ten-foot bed of shale lies a fifteen-foot stratum of "argillaceous, grayish shale." Next is described the "Upper Freeport Coal. A thin seam of rather good quality. * * * Thickness, fifteen inches." Above this in turn is "Stratum No. 20." This is the stratum from which the fossils in question were collected and which White refers to the Uffington Shale. As Stevenson informed White that most of his fossils were collected at the town of Uffington, we should expect that the former's description of the fossiliferous stratum would have been derived from his observations and measurements of the bed either at this point or on Deckers Creek, where he states the bed is best exposed. As has been shown above, the Uffington Shale of I. C. White has, at Uffington, a thickness of 30 feet. Stevenson's description of "Stratum No. 20" is given for comparison:

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[18] "A geological examination of Monongalia County, West Virginia, by John J. Stevenson; together with lists of fossils and descriptions of new species, by F. B. Meek," West Virginia University, Board of Regents, Third Annual Report, 1871, for the year 1870, p. 49. See also pp. 50 and 51.

[19] West Virginia Geological Survey, Vol. II, 1903, p. 422.

> "20. Shales. Dark colored, fine grain, argillaceous, and contains many small nodules of iron ore. It appears to be identical with a stratum of dark shale in Ohio, underlying the Mahoning sandstone, and like this, abounding in fossils[20]. These fossils are referable chiefly to *Productus, Nucula, Yoldia, Macrocheilus* and *Bellerophon*. Specimens of *Phillipsia* have been found here. This stratum is seen to best advantage in the bluff bordering the 'bottoms,' two or three hundred yards above the old 'Point House.' Thickness, twelve feet."

Thus, only 12 feet of shale is said to intervene between the coal and the next succeeding stratum, "No. 21, Mahoning Sandstone," while at Uffington 30 feet of shale and shaly sandstone intervenes.

From some time prior to 1800, until about 1855, the Deckers Creek Iron Works[21] operated two furnaces and a forge on Deckers Creek near Morgantown. One furnace was at Dellslow, 2½ miles southeast of the present corporate limits of Morgantown. The second furnace stood on top of the bluff of the Buffalo Sandstone on the south bank of the creek at the present railroad station of Rock Forge on the Morgantown and Kingwood Railroad. The old forge stood 250 yards down stream from this furnace. Up stream from the furnace, on top of the same bluff, still stands the frame dwelling, or a portion of it, formerly known as the "Point House." This building was a boarding and rooming house for laborers at the iron works. The "bluff bordering the bottoms" at the "Point House" and extending for several hundred yards along the stream in each direction is composed of the following strata, as determined by the writer, by hand-level measurements, beginning at the level of Deckers Creek at a point 800 feet east of Rock Forge station on the Morgantown and Kingwood Railroad, and ascending the bluff to the level of the stream terrace above:

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[20] In "Carb. of the Appal. Basin" no mention is made of this Ohio fauna; nor is such a fauna described by D. D. Condit and C. G. Mark in their monograph on the Conemaugh formation of Ohio, Ohio Geol. Surv., 4th ser., Bull. 17, 1913. On p. 57, Condit writes: "Near Morgantown, West Virginia, shales rich in marine fossils overlie the Upper Freeport coal. Dr. White has named these the Uffington shales. It is not unusual to find shales occupying much of the lower Mahoning horizon in Ohio, but no marine fossils have been discovered in them."

[21] S. T. Wiley, History of Monongalia County, 1883, and G. P. Grimsley, West Virginia Geological Survey, Vol. IV, 1909, p. 110.

Section at Rock Forge (old "Point House.")

		Thickness.		Total.	
		Ft.	In.	Ft.	In.
1.	Concealed, containing Brush Creek coal	3	0	3	0
2.	Shale, dark, Brush Creek limestone horizon; marine fossils aboundant.......	13	0	16	0
3.	Sandstone, Buffalo, massive, cross-bedded; weathering irregularly; cavities formed by leaching of cement of sand grains; small lenses of shale locally interstratified with the sandstone...	30	0	46	0
4.	Alluvium, Quaternary, sand and gravel on stream terrace at top of bluff; thickness variable..................	5	0	51	0

At this point the Brush Creek Coal and fossiliferous shale are just above drainage. To the west the Buffalo Sandstone soon comes down to water level and to the east the strata rise on the western limb of the Chestnut Ridge Anticline. At Richard, seven-tenths of a mile northeast of the "Point House," the Upper Freeport Coal, of the correlation of White, rises to the creek level with the Mahoning Sandstone resting immediately upon it, the Uffington Shale having been removed by erosion[22]. Therefore, the true Uffington is not present at the "Point House" and the coal and fossiliferous shale (Brush Creek) observed by the writer agree closely with Stevenson's "Upper Freeport" Coal and his "Stratum 20—Dark shale just below the Mahoning Sandstone."

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[22] West Virginia Geological Survey, Report on Monongalia, Marion and Taylor Counties, 1913, p. 714.

NOTES ON THE POSSIBLE EVIDENCE OF THE PRESENCE OF A PAREIASAURUS-LIKE REPTILE IN THE CONEMAUGH SERIES OF WEST VIRGINIA.

By Prof. E. C. Case.

Several years ago a most interesting specimen was found by Mr. Ray V. Hennen, Assistant Geologist of West Virginia, in the Conemaugh Series of that State. The specimen consists of a sandstone cast, apparently of a large leg bone; in its general appearance, superficial markings and probable articular facets it gives every evidence of being a cast of a bone, but it is entirely devoid of any bony structure. This specimen was submitted to Dr. H. F. Osborn, who was at first inclined to regard it as a bone, but after having had it sawed in two and finding no trace of bony structure, he came to the conclusion that it was inorganic in origin. Later the specimen was submitted to the Society of Vertebrate Paleontologists at one of their meetings, and the concensus of opinion was that it was the cast of a bone. The specimen was then entrusted to Dr. S. W. Williston for description, but as he did not take up the matter for several years, it was finally placed in the hands of the author.

In re-examining the specimen after several years, the author is still unable to see any reason, other than the geological horizon in which it was found, to doubt that it is the cast of a cavity formed by the removal of a bone. Just such casts have been repeatedly found and just such casts would have resulted if the cavities formed by the solution of the bones buried in the Elgin sandstones of Scotland had been filled by a matrix of finer sand. Exactly such casts occur in the Permian of Brazil.

As shown in the photographs and figures, the specimen appears to be a cast of a complete bone with one end free and the other attached to a mass of matrix. The cast proper is composed of much finer material than the attached matrix, and is marked off from it by a distinct line traceable nearly all the way around the end; the matrix could probably be very easily removed as a slight exploration with the chisel revealed a parting marked by a slight discoloration. These facts, with the peculiar form of the specimen and the lack of any nucleus or concentric structure, are strongly against the supposition that the specimen is a concretion. Any assumption that the specimen, so closely resembling a bone, is a cast of an accidental cavity is fully as violent, even more so, than the assumption that an animal possessing such a bone lived in Conemaugh time.

Choosing the assumption that the specimen is a cast of a cavity formed by the solution of a bone, the evidence in its favor is set forth below.

The locality and geological horizon of the specimen:

Mr. Ray V. Hennen has kindly furnished the author with the following details of the discovery. "It was lying loose on top of an outcropping sandstone ledge of the Conemaugh Series of the Pennsylvanian, about 200 feet below the Pittsburgh Coal bed and base of the Monongahela Series, in Braxton County, West Virginia, 0.7 mile north of Saltlick Bridge P. O., on the west side of the public road and west hillside, at an elevation of 975 to 1000 feet above sea-level.

Reptiles existed much earlier than is indicated by this horizon. *Eosauravus copei* Will. occurs in the Lower Freeport horizon in the cannel coal of Linton, Ohio, well down in the Allegheny. The author has described reptiles closely similar to the Permo-Carboniferous reptiles of Texas from beds just below the Ames Limestone, 400 feet below the top of the Conemaugh. Fragments of the spine of the highly specialized Permo-Carboniferous reptile *Edaphosaurus* (*Naosaurus*) have been discovered in the Lower Marietta Sandstone of the Dunkard Series, near Marietta, Ohio.

Pareiasaurian and Cotylosaurian reptiles were among the earliest, if not earliest, to appear, and they very speedily developed a relatively great variety of forms, some of them large enough to have possessed bones such as are suggested by the cast. There was a large land area to the east of the area of deposition in West Virginia in Pennsylvanian time, upon which such animals might have lived, and it would only have been by accident that their remains would have been carried so far out into the swampy or submerged area. The place of origin of the reptiles of this type is unknown; North America was, in all probability, isolated in Permian and Permo-Carboniferous time from the rest of the world and its reptilian and amphibian faunas show little relationship to those of other lands, but suggestions of a genetic relationship between the North American and the South African primitive reptiles have been made (Cope, Williston, Broom). The author has taken a position in opposition to this view. Broom has suggested that the primitive reptilian fauna originated in the highlands of north central South America and from there migrated to all quarters of the globe; this suggestion is based on somewhat vague assumptions as to land connections and a dependence on the verity of the continent of Gondwana land, a matter that is now somewhat in question. The only unquestioned connection between North America and South Africa in Permian and Permo-Carboniferous times would have been by way of the North Atlantic Continent, and this seems a very long route and no trace of any reptiles at all comparable to the ones suggested by the cast have been found along such a route. There is, however, no inherent improbability of the existence of large primitive reptiles upon the continent of Appalachia in Conemaugh time either by autocthonous origin or by migration, and it must be remembered that no search for vertebrate fossils has ever been made in the eastern Coal Measures by experienced "bone-hunters."

All opposition to the suggestion that the specimen is a true cast of a bone must be based on the assumed inherent improbability of the presence of reptiles in the time and place where it was found and upon the purely negative evidence of the lack of other specimens where no careful search has been made for them.

The appearance of the specimen:

As stated above, the appearance of the specimen is that of a cast of a bone, and if it had been discovered at a higher horizon its nature would not have been questioned. As shown by the accompanying figures and photographs the specimen has distinctly expanded ends, a contracted shaft with one part produced into a sharp ridge. The distal (?) end is free from matrix and shows well formed depressions which may be either articular facets or may be entirely due to solution. The opposite end is closely joined to the matrix, but shows a distinct mark of separation.

The surface shows irregularities, rugose areas, and roughened lines near the ends, which are all markings such as would appear upon a bone. It is obviously unsafe to make comparisons from a single specimen of this character, but certain bones are so very similar in appearance that it seems wise to figure them and point out the similarities. The only bones with which the specimen can be compared are the radii of the genera *Propappus* and *Pareiasaurus* of the family Pareiasauridae from the lowest bone bearing horizons of the South African Permian. Above the Ecca conglomerate, which is reckoned as the base of the Permian, are the clays and clay-stones of the bone bearing horizons, the Pareiasaurus and the Endothiodon zones which have furnished many good specimens of the family Pareisauridae.

In figures 1, 2, 3 are shown views of the West Virginia specimen; in figure 5 is shown the radius of *Propappus rogersi,* a small Pareisaurian; in figure 6 the same bone of *Pareiasaurus serridens* (both copied from Broom); in figure 7 the same bone of *Pareiasaurus baini* (copied from Seeley). The similarity is obvious, especially in the hook-like projection of the distal(?) end.

The measurements indicate very similar proportions and in the case of two of the specimens very similar size.

	W. Va. spec.	Propappus.	P. baini.	P. serridens.
Length	247.6	164	234	215.7 mm
Distal (?) end....	90×60	78×60	108	98
Opposite end.....	110×85	86×60	123	104.5

It would be unwarranted to assert upon the evidence of this specimen alone the presence of a Pareiasaurian reptile of large size upon the eastern side of North America in middle Pennsylvanian time, but the author is of the opinion that the specimen is a cast of a bone of a large Pareiasaurus-like reptile; he finds the nearest resemblance to it in the bones of Pareisaurians from the Permian of South Africa and sees no inherent impossibility of the presence of such a creature in the time and place where it was found.

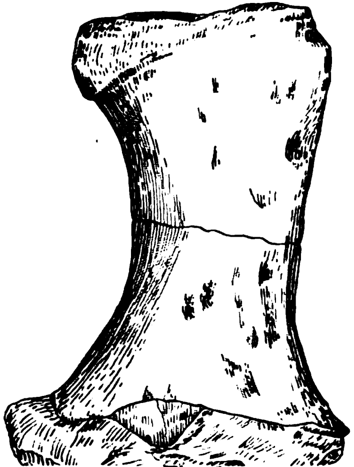

Fig. 1.

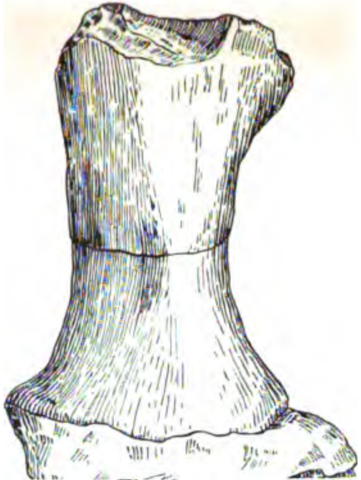

Fig. 2.

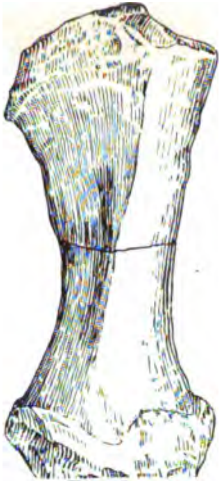

Fig. 3.

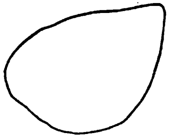

Fig. 4.

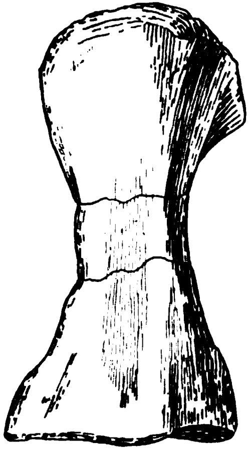

Fig. 5.

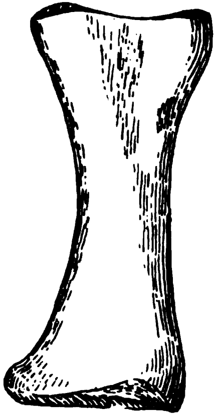

Fig. 6.

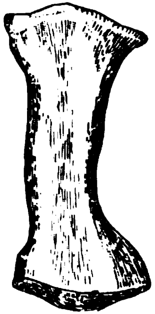

Fig. 7.

PLATE XXVIII.—(See "List of Figures" on page 821 for description.—Figs. 1-4, West Virginia specimen. (*Parciasaurus? henneni*).

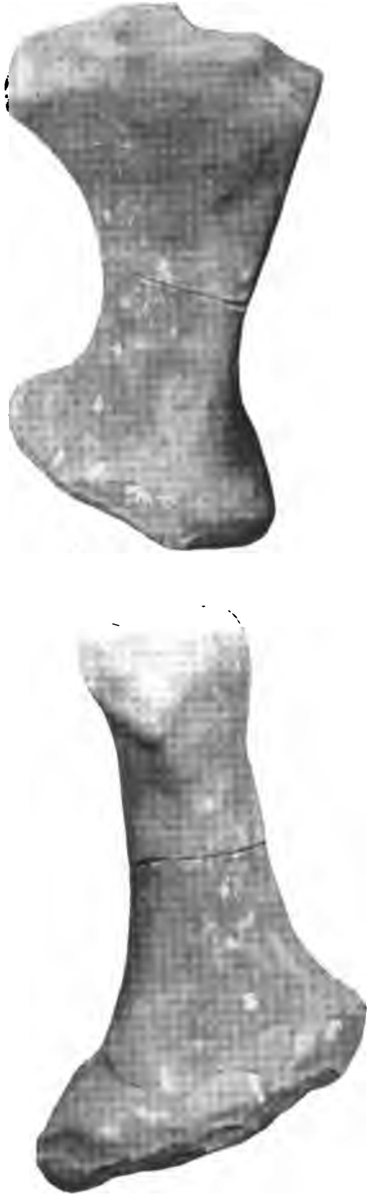

PLATE XXIX.—Photographs of the West Virginia specimen (*Pareiasaurus? henneni*).

List of Figures.

Plate XXVIII:

Fig. 1.—Lateral view of the West Virginia specimen.

Fig. 2.—View of the opposite side of the West Virginia specimen.

Fig. 3.—View showing the sharp ridge on the West Virginia specimen.

Fig. 4.—Outline of the cross-section of the West Virginia specimen at the cut.

Fig. 5.—Radius of *Propappus rogersi.* After Broom.

Fig. 6.—Radius of *Pareiasaurus serridens.* After Broom.

Fig. 7.—Radius of *Pareiasaurus baini.* After Seeley.

All figures x ¼.

Plate XXIX.—Photographs of the West Virginia specimen (*Pareiasaurus ? henneni*).

NOTE BY I. C. WHITE, STATE GEOLOGIST.

Prof. Case, who has written the above interesting description of the fossil cast discovered by Assistant Ray V. Hennen, did not think best to give it a name until other portions of the skeleton had been found. However, the writer can see no good reason in leaving the specimen unnamed, while there are many valid ones from the standpoint of future reference and comparison, when other reptilian bones are found in these Conemaugh red beds. That many others will be found when proper search is made is practically sure, and hence in view of the affinities upon which all who have seen the specimen agree; viz, that it represents a fossil reptile close to if not identical with the genus Pareiasaurus of the South African Permian, I have designated the bone as *Pareiasaurus? henneni*, the specific name being given after its discoverer, Ray V. Hennen, Assistant Geologist of the West Virginia Geological Survey. Should future discoveries prove this relationship in error, no harm will have been done, and in the meantime reference to this specimen by other writers or observers will be much facilitated.

In this connection it should be remembered that the writer has for many years suggested and contended that the sudden introduction of **Red sediments** into the **Conemaugh Series**, after their total absence since the close of Mississippian time when a long period of erosion supervened, was an event of unusual importance in geologic history. In fact, so distinctive as to warrant the last chapter of the Pennsylvanian being closed at that horizon, and the first chapter of the Permian or Permo-Carboniferous opened with the deposition of these **Conemaugh red beds.**

The Permian reptilian fauna[1] already described by Case from the horizon 34-40 feet below the Ames Limestone at Pitcairn, Pennsylvania, proves incontestably that Permian vertebrate life had already arrived in the Appalachian field, just as it had in the western coal fields at the closing stage of the Illinois Coal Measures, and hence there can be no valid reason why representatives of Pareiasaurus may not have been among the arrivals that accompanied the new conditions producing the **Pittsburgh Red Shales** that succeeded the great white sandstone epoch which began with the Pottsville on top of the **Mauch Chunk Red Beds,** and closed with the deposition of the Mahoning, Buffalo, and Saltsburg Sandstones making up the lower one-third of the Conemaugh Series as now delimited. The marine fauna in the Ames Limestone is largely composed of forms common to the Permian beds, as may be seen from the following list of species identified from West Virginia localities by Stevenson, Meek, Beede, Price and others, as compiled by Wm. Armstrong Price:

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[1] **Annals Carnegie Museum, Vol. iv, pp. 234-241; April 1, 1908.**

Endothyra ? sp	x*
Serpula ? sp	x
Vermes indet. (trails?)	x
Crinoidea (plates and stems)	a
Rhombopora lepidodendroides?	x
Lingula umbonata	x
Orbiculoidea missouriensis	x
Rhipidomella pecosi	x
Derbya crassa	a
Derbya robusta	x
Chonetes granulifer	aa
Productus cora	c
Productus semireticulatus	x
Productus pertenuis	c
Pustula symmetrica	x
Pustula nebraskensis	a
Strophalosia sp	x
Spirifer cameratus	x
Ambocoelia planiconvexa	aa
Composita subtilita	x
Composita sp	x
Solenomya radiata	x
Solenomya soleniformis	x
Solenomya trapezoides?	x
Prothyris elegans	c
Solenopsis solenoides	x
Edmondia? scutum	x
Edmondia ovata var. levis	x
Edmondia gibbosa	x
Edmondia sp	x
Nucula anodontoides	a
Nucula ventricosa	x
Nucula parva	aa
Anthraconeilo taffiana	a
Yoldia propinqua	x
Yoldia sp	x
Leda bellistriata ?	c
Leda meekana	a
Parallelodon obsoletus	c
Aviculipinna americana	x
Aviculipinna nebraskensis	x
Pseudomonotis hawni	x
Myalina subquadrata	c
Myalina perniformis	x
Schizodus affinis ?	x
Schizodus ulrichi ?	x
Aviculipecten rectilaterarius	c
Acanthopecten carboniferous	c
Deltopecten occidentalis	a

Pectenoidea (fragments)	x
Lima retifera	x
Allerisma terminale	c
Pleurophorus oblongus?	x
Pleurophorus occidentalis	a
Pleurophorus cf. obsletus	c
Pleurophorus? sp	c
Pleurophorella geinitzi	x
Astartella gurleyi	x
Astartella concentrica	x
Pelecypoda indeterminata (several species)	x
Bellerophon crassus var. wewokanus	x
Patellostium montfortianum	aa
Patellostium kansasensis	x
Bucanopsis perlata	a
Bucanopsis stevensana?	x
Bucanopsis meekiana	x
Bucanopsis? sp	x
Euphemus carbonarius	aa
Pharkidonotus percarinatus	x
Pharkidonotus percarinatus var. tricarinatus	a
Worthenia cf. speciosa	a
Worthenia (Orestes) intertexta	a
Phanerotrema grayvillense	a
Schizostoma catilloides	a
Loxonema semicostatum	x
Zygopleura plicata	c
Zygopleura rugosa	x
Zygopleura scitula	x
Zygopleura sp	x
Soleniscus paludinaeformis ?	x
Bulimorpha chrysalis	x
Sphaerodoma ? brevis	x
Sphaerodoma ? primigenia	x
Sphaerodoma ? primigenia var. intermedia	x
Sphaerodoma ? ventricosa	x
Aclisina swallowana	x
Aclisina ? sp	x
Orthonema quadricarinatum	x
Orthonema cf. subtaeniatum	x
Orthonema ? sp	x
Minute, open-spiraled gastropod	x
Gastropoda indeterminata (coils)	x
Orthoceras sp	x
Pseudorthoceras knoxense	x
Tainoceras occidentale	x
Ostracoda	a
Eumalacostracean arthropod fragments	x
Boring organism	x

True, this list of Ames Limestone fossils contains many that occur in the Pennsylvanian strata of this and other States, but that is no reason why they may not have continued to live on into Permian time.

The Permian or Permo-Carboniferous age of these Conemaugh red beds is also confirmed by fossil plant remains recently discovered a short distance above the horizon of the Ames Lime-

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***Abbreviations: "x" rare, at one or more localities; "c", common; "a", abundant; "aa", very abundant.**

stone as related to me in a personal communication by Mr. David White, Chief Geologist of the United States Geological Survey, who states that a species of Callipteris, a genus diagnostic of Permian beds, has recently been discovered in the upper half of the Conemaugh. In this connection it is pertinent to quote here the opinions of the writer concerning the age of these Conemaugh beds, as published in the Reports of the West Virginia Geological Survey, beginning with his first description of the Conemaugh Series as given in Volume II, Coal Report, under date of June 15, 1903, pages 225-227:

The Conemaugh Series.

"As now limited, it includes all of the strata from the floor of the Pittsburgh Coal down to the top of the Upper Freeport bed, the whole having an average thickness of 600 feet, though it varies from 400 on the western margin of the Appalachian field in Ohio, to 800 feet near Charleston, W. Va.

"The series as thus limited above and below, consists of two widely different members, lithologically considered, the upper composed largely of soft, red, and marly shale, the lower of massive, pebbly sandstones. The difference in the rock type is so marked, and especially in the character of the topography made by each, that the First Geological Survey of Pennsylvania and Virginia placed them in two different series, the massive sandstones, at the base of the Conemaugh, being classed with the underlying Allegheny. That assignment, based primarily upon difference of rock type, was more philosophical than the present limitations but the fact that no definite boundary (a sandstone always being subject to sudden and rapid change in both thickness and character) could be assigned to either the lower limits of the upper one, or the upper limits of the lower one, led Profs. Stevenson, Lesley, and other Pennsylvania geologists to extend the limits of the 'Lower Barren Measures' of Rogers down to the horizon of the Upper Freeport Coal, a well marked and widely persistent stratum. This arrangement gives definiteness to classification, a great desideratum, but it has the fault of bringing together rocks of very different type, and hence, while apparently preferable to the old and indefinite dividing line between the two series, is yet not altogether satisfactory. Hence, it is possible that a future and more detailed study of the series in West Virginia may reveal some more desirable dividing plane between the Conemaugh Series and the underlying Allegheny than the present one, (Upper Freeport Coal), which will retain all of the desirable features of the Rogers classification and at the same time relieve it of indefiniteness.

"Viewed from the standpoint of change in physical conditions, the proper place for such a dividing plane between the Conemaugh and Allegheny beds, would be the first general appearance of RED ROCKS, near the horizon of the Bakerstown Coal about 100 feet under the Ames or Crinoidal Limestone horizon. That a great physical change took place soon after the deposition of the Mahoning Sandstone rocks, the present basal members of the Conemaugh Series, must be con-

ceded, since no RED BEDS whatever are found from the base of the Pottsville up to the top of the Allegheny, and none worth considering until after the epoch of the Upper Mahoning Sandstone.

"The sudden appearance or disappearance of RED sediments after their absence from a great thickness of strata is always accompanied by a great change in life forms, and the present one is no exception. In fact, the invasion of RED SEDIMENTS succeeding the Mahoning Sandstone epoch of the Conemaugh may well be considered as the 'beginning of the end' of the true Coal Measures, both from a lithological as well as a biological standpoint, and hence it is possible that the best classification aside from the conveniences of the geologist, would leave the Mahoning Sandstone in the Coal Measures, and place the rest of the Conemaugh, as well as the Monongahela Series above, in the Permo-Carboniferous. This reference is also confirmed by the character of the fauna and flora, both of which contain many forms that characterize the Permo-Carboniferous beds of Kansas and the West as may be seen in the lists published on a subsequent page under the detailed description of the principal Conemaugh strata.

"As already stated, the two types of rock (hard and soft) included in this series, give rise to two widely distinct varieties of both soil and topography. The uppermost 400 feet of soft beds with their included thin limestones, and limy, red, yellow, and greenish shales, interstratified with two or three rather massive sandstones, give origin to a beautiful rolling topography often finely adapted to grazing and agriculture, especially where these beds cover the uplands not deeply trenched by draining streams. When the hills are high and steep, however, the red marly shales exhibit a great tendency to landslides, and hence where such topography abounds, grazing rather than agriculture should be the chief occupation for these Conemaugh soils.

"A wide band of RED marks the crop of this soft portion of the Conemaugh entirely across the State from the Pennsylvania line on the north to the Big Sandy River at the Kentucky boundary, 250 miles distant to the southwest."

Likewise in Volume II(A), Supplementary Coal Report, West Virginia Geological Survey, published under date of September 15, 1908, on pages 622-624, inclusive, the writer used the following language in describing

The Conemaugh Series.

"Sediments **inherently red**, make their appearance for the first time in this series since the close of the **Mississippian**, with the top of the **Mauch Chunk Red Shale**. True, a **pink**, or **reddish color** in the **ferriferous** clays, or shales of the upper portion of the **Allegheny Series** may sometimes be seen, as near Ft. Gay on the Big Sandy, and near Coal Grove above Ironton, Ohio, but these apparent **reds** are from oxidation due to weathering since these sediments were not **red when deposited**, and if a bore hole could be sunk through them a few feet in from their crops, no **reds** would appear. The genuine **red beds** of the Conemaugh were deposited as **red muds** from an old eroded land surface and are inherently **red** whether at the surface, or 1500 feet below the same, as is the **Pittsburgh Red Shale** in some portions of Wetzel, Monongalia, and other counties in the center of the Appalachian basin.

"The general statements on pages 165, 226, and 227, Volume II, about the importance of the sudden appearance of **red beds** after their absence from the strata for a long period of time, and the possibility that the lowest **Conemaugh reds** might mark the dividing line between important formations, such as the true **Coal Measures** and the **Permo-Carboniferous**, has received strong confirmation during the past year. Dr. Percy E. Raymond of the Carnegie Museum has discovered in these **red shales**, near Pittsburgh, at 35 feet below the **Ames Limestone** an interesting **Reptilian fauna** which is closely related to **Permian types.** This fauna, including species of the general *Eryops, Desmatodon,* and *Naosaurus,* allied closely to what have been regarded as Permian forms in Illinois and Texas, has been recently figured and described by Prof. E. C. Case, in the Annals of the Carnegie Museum, Vol. IV, pages 234-241, April 1st, 1908. It is quite possible that a considerable **break** in the geologic record occurs at the close of the great sandstone epoch ending with the **Saltsburg** horizon just above the **Bakerstown Coal** where the great invasion of **red beds begins.** Although there is little or no unconformity in dip at this horizon, there may be a real unconformity of considerable extent since the variation in the thickness of the sandstone deposits at the base of the **Conemaugh** is very great indeed.

"In connection with the consideration of these **Permian land reptiles** discovered at Pitcairn, Pa., in the **Pittsburgh Red Shales** by Dr. Raymond, it should be mentioned that in 1906 Mr. Ray V. Hennen, Assistant Geologist, discovered what appears to be a perfect **Tibia** of a large reptile allied to *Pareiasaurus* according to Osborn, but who after making a cross-section of the supposed bone, and finding no bony structure preserved, pronounced it a concretion, the most remarkable one he had ever seen. Many geologists, and other vertebrate paleontologists who have seen the specimen, declare that its concretionary origin is not proven, and that it is most probably a sandstone cast, an actual **fossil** from which all bony structure and organic material have disappeared before lithification in its porous matrix, thus preserving only the outside surface and shape of the bone to perfection.

"Mr. Hennen found it lying loose upon the surface, near Salt Lick Bridge, Braxton County, a few feet above the horizon of the **Ames Limestone**, where it had evidently weathered out of its original matrix in a greenish, micaceous, fine-grained sandstone. Of course the testimony of this specimen will remain of doubtful value until its true nature is determined beyond question by the discovery of other **concretions** or **fossils** as the case may be in this same region. In this connection it should also be remembered that Scudder in his Bulletin No. 124, U. S. G. Survey, has described a **fossil insect fauna** from just above the **Ames Limestone** near Steubenville, Ohio, in which he finds forms greatly resembling those in the lower **Dyas** or **Permian** of Weissig, Saxony, and hence it should not be surprising to find **Permian Reptilian forms** in these **Conemaugh red beds** which the writer has for several years insisted were more nearly related to the **Permian** than to the **Carboniferous** proper, and that the introduction of **red sediments** after such a long absence marked a change in physical and biological conditions sufficiently great to warrant a division of the geologic column at or near the horizon of the **Ames Limestone.** It was formerly suggested that this division should come just above the **Ames horizon,** since its deposition marked the end of marine life in

the Appalachian field, but the discoveries of Dr. Raymond of a Permian reptailian fauna at several feet below the Ames Limestone would tend to show that this division line should be drawn at the base of the Pittsburgh Red Shale, about 100 feet below the Ames horizon, or the top of the Saltsburg Sandstone.

"As these first red deposits were probably laid down upon an eroded land surface, the great irregularity of their thickness (which varies from 10 to 200 feet) below the Ames Limestone would be thus readily explained."

The peculiar type of fossil insects referred to above are described by the late Prof. Samuel H. Scudder in Bulletin 124, U. S. Geological Survey, and on page 12 of the same he gives his reasons for regarding not only those found in the Cassville Plant Shale as above the horizon of the Pennsylvanian Coal Measures, but also those found near the Ames Limestone near Steubenville, Ohio, in the following language:

"The West Virginia locality is at Cassville, Monongalia County, not far from Morgantown, and the specimens were found in rocks lying above the Waynesburg Coal, in what is termed by Prof. I. C. White the Dunkard Creek series, and referred very positively by him and Prof. Wm. M. Fontaine to the Permian. The blattarian fauna as thus far determined is unquestionably younger than any known from the Pennsylvania or Illinois rocks, on which we have hitherto depended largely for our knowledge, and consists of a vast assemblage of forms, which will undoubtedly be increased by further search. They number fifty-six species, belonging to five genera, the bulk of them (thirty-six species) to Etoblattina.

"The Ohio locality lies at the edge of the township of Richmond, on Wills Creek, in the near neighborhood of Steubenville, Jefferson County, and though far less extensive and less thoroughly worked than Cassville, has already yielded twenty-two species belonging to three genera, of which the larger number (seventeen) belong to Etoblattina and the others to the genera represented at Cassville by more than a single species.

"It is a curious fact, to which I called partial attention when first describing some of them, that these species represent for the most part a distinct group of cockroaches of the genera *Etoblattina* and *Gerablattina*, characterized by great length and slenderness of the internomedian area, by a remarkable openness of the neuration in the middle of the tegmina, and by their frequently exceptional length and slenderness. They comprise, indeed, nearly 75 per cent. of the spcies of these two genera at Richmond, and hardly occur elsewhere excepting at Cassville, where they compose about 25 per cent. of the species of these two genera. The only occurrence of a similar form in Europe is *Etoblattina Elongata* from the lower Dyas of Weissig, Saxony. The occurrence of this type of cockroaches is the characteristic feature of Richmond, and must place this fauna high in the series, as the stratigraphical evidence itself warrants. Its horizon, according to Mr. Huston, who alone has explored the location, is in the Barren Coal Measures, a little above the Crinoidal Limestone.

> "It is remarkable that, notwithstanding the close relationship in general features of the two rich faunas, of Cassville and Richmond, not a single species has been found common to the two. One species, indeed, I formerly regarded as found in both, but a closer study convinces me that there are in this case two nearly allied forms, and they are accordingly separated in this paper. Further than this, with one or two exceptions, no American species has been found in two different places, and without exception the American species are completly distinct from the European."

Hence, we see that not only the Reptilian life, but also the insect and plant life of the Conemaugh supports the conclusion that the beginning of **red sediments** in the Conemaugh Series marks the dawn of Permian time, while there is nothing in the marine life of the epoch to contradict the same when properly interpreted. The presence of the peculiar type of Odontopteris, like *Odontopteris* (*Lescurites*) *moorii*, in the horizon 20 feet below the great Pittsburgh Coal, near Wheeling, West Virginia, as identified by Fontaine, and also in the roof shales of the same near Greensburg, Pennsylvania, also confirms the very late age of the Monongahela Series and would thus support the conclusion that the base of the Rothliegunde or Dyas should be brought down from the top of the Waynesburg Coal to near the base of the Conemaugh Series or to the zone of the first appearance of red sediments in that series where there appears to be a true unconformity, or rather disconformity.—I. C. W.

APPENDIX.

LEVELS ABOVE MEAN TIDE.

RAILROAD LEVELS.

THE BALTIMORE AND OHIO RAILROAD.

West Virginia and Pittsburgh Branch.

Distances from Clarksburg	STATIONS.	County.	Elevation.
49.1	Jane Lew Lumber Siding......	Braxton....	....
49.7	D. H. Dowing Lumber Siding...	Braxton....	....
49.8	Burnsville Grocery Co.........	Braxton....	....
49.9	Burnsville Flour Mill..........	Braxton....	....
49.9	BURNSVILLE	Braxton....	775.90
52.0	Coger	Braxton....	775.90
56.5	Highland Lumber Siding.......	Braxton....	778.90
56.8	Rollyson	Braxton....	803.90
58.3	Heaters	Braxton....	864.90
58.4	Smith Brothers Planing Mill....	Braxton....	....
60.1	Berry Siding..................	Braxton....	1076.90
61.6	Shaversville	Braxton....	....
61.7	Fisher & Berry Lumber Co.....	Braxton....	....
62.2	Flatwoods	Braxton....	1142.90
63.9	Hopkins	Braxton....	1033.40
64.6	Morrison	Braxton....	1091.00
64.8	No. 2 Tunnel.................	Braxton....	894.00
67.6	Gillespie	Braxton....	....
67.6	G. F. Stockert Lumber Co......	Braxton....	....
67.6	W. Va. Pulp & Paper Co.......	Braxton....	....
67.6	J. A. Baker, Lumber...........	Braxton....	....
69.7	HOLLY JUNCTION...........	Braxton....	920.20
72.4	Bakers Run...................	Braxton....	939.20
74.4	CENTRALIA	Braxton....	953.50
74.4	John Paulhamus & Son.........	Braxton....	....
76.5	Custis	Braxton....	1071.10

Sutton Branch of the West Virginia and Pittsburgh Branch.

Distances from Flatwoods	STATIONS.	County.	Elevation.
0.0	FLATWOODS	Braxton....	1142.90
.....	Summit........................	Braxton....	1187.90
1.7	McNutt	Braxton....	1061.90
3.4	Karl Siding...................	Braxton....	889.90
5.6	SUTTON	Braxton....	838.90
5.6	Sutton Grocery Co............	Braxton....	....
5.6	Pardee-Curtin Lumber Co......	Braxton....	....

COAL AND COKE RAILWAY COMPANY.

Main Line.

Distances from Charleston	STATIONS.	County.	Elevation.
24.4	Queen Shoals	Kanawha	638
27.6	Porters	Clay	644
28.9	Rand	Clay	646
30.3	King	Clay	651
31.8	Camp	Clay	651
35.9	Shelley Junction	Clay	663
38.4	Birch	Clay	669
39.5	Shelton	Clay	672
41.1	Big Sycamore	Clay	674
44.2	Elkhurst	Clay	682
47.2	Middle Creek	Clay	699
48.1	Upper Leatherwood	Clay	701
50.8	CLAY C. H.	Clay	706
51.9	Dundon	Clay	711
57.3	Spread	Clay	....
61.2	Standing Rock	Clay	....
63.6	Otter	Clay	....
65.7	Jessica	Clay	....
70.3	Groves	Clay	786
73.7	Villa Nova	Clay	....
76.6	Strange Creek	Braxton	806
79.1	Glendon	Braxton	814
81.6	Rockton	Braxton	....
83.2	Frametown	Braxton	....
87.4	Shadyside	Braxton	827
91.8	GASSAWAY	Braxton	834
95.2	Little Otter Tunnel No. 12	Braxton	1055
95.7	Pembroke	Braxton	1039
97.3	Riffle	Braxton	952
99.1	Exchange	Braxton	872
102.1	Copen Tunnel No. 11	Braxton	1053
102.3	Delta	Braxton	1035
105.6	Copen	Braxton	865
107.4	Bower	Braxton	796
109.0	Gilmer	Gilmer	762
110.7	Hyers	Braxton	759
113.8	BURNSVILLE	Braxton	780
118.0	Orlando	Lewis	782

Sutton Branch.

Distances from Gassaway	STATIONS.	County.	Elevation.
0.0	Gassaway	Braxton	834
4.0	Bison	Braxton	841
6.5	SUTTON	Braxton	842
8.7	*Wolf Run	Braxton	854

*Track not laid between Sutton and Wolf Run.

BUFFALO CREEK AND GAULEY RAILROAD.

Miles from Coal & Coke Ry. Connection	STATIONS.	County.	Elevation.
0.0	Coal & Coke Ry. Connection....	Clay.......	711
0.5	Dundon	Clay.......	711
0.8	Big Buffalo..................	Clay.......	714
1.8	Avoca	Clay.......	721
4.1	Hamrick Run..................	Clay.......	759
5.8	Devils Saw Mill..............	Clay.......	777
6.7	Sand Fork....................	Clay.......	795
8.6	Cressmont	Clay.......	838
9.5	Rock Camp....................	Clay.......	852
11.7	Whetstone	Clay.......	899
14.1	Robinson Fork................	Clay.......	964
15.0	Taylor Fork..................	Clay.......	1006
17.2	Pheasant Run.................	Clay.......	1107
17.9	WIDEN (Rich Run).............	Clay.......	1126
18.7	Murphys	Clay.......	1162

U. S. GEOLOGICAL SURVEY* LEVELS.

BURNSVILLE QUADRANGLE.

From Arnoldsville southwest along Baltimore & Ohio R. R. to Burnsville, thence northwest along highway to Linn.

Feet.

Confluence 2.6 miles northwest of, 4.6 miles southwest of Arnold, on Second Big Run, on southwest corner of east abutment of railroad bridge 43 A; chiseled square........ 802.93

Confluence, 0.4 mile northeast of, opposite forks of county road, on north corner of pier of railroad bridge 46 A; chiseled square.. 777.01

Confluence, 0.8 mile southwest of, at forks of road, on northwest corner of west pier of railroad bridge 47 A; chiseled square.. 775.42

Burnsville, 0.5 mile north of, in top of east corner of northeast pier of railroad bridge 50 A over Little Kanawha River; bronze tablet stamped "765 Grafton"............. 764.366

Stouts Mills, iron bridge over Little Kanawha River, in northwest corner of east abutment; bronze tablet stamped "750 Grafton".. 749.624

From Burnsville southeast along road to Bulltown, thence west to point 1 mile north of Rollyson.

Bulltown, in north face of west abutment of covered bridge over Little Kanawha River, 9.8 feet below bridge seat and 8.1 feet west of corner; bronze tablet stamped "777 Grafton" 776.538

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*From Bulletin 632, U. S. G. Survey, 1916.

From Burnsville south along Baltimore & Ohio R. R. and highways to Heaters.

	Feet.
Burnsville, 1.7 miles south of, on northwest corner of south abutment of railroad bridge 52A over Saltlick Creek; chiseled square	764.89
Cogers, 3.4 miles south of, on northeast corner of south abutment of railroad bridge 55D over Saltlick Creek; chiseled square	785.46
Rollyson, 0.5 mile north of, in bridge seat at northeast corner of south abutment of railroad bridge 57 D; bronze tablet stamped "797 Grafton"	796.684
Heaters, on southeast corner of west abutment of highway bridge over O'Brien Fork; chiseled square	864.97

GLENVILLE QUADRANGLE.

From Cedarville southeast along highway to Cutlips.

Cedarville, at front of residence of W. H. Jack, on west side of cut-stone steps, in big stone; aluminum tablet stamped "802 Grafton"	802.813
Cedarville, 6 miles southeast of, near house east of road, on big stone; chiseled square	822.79
Hope, about 2.5 miles east of, at forks of road leading up Toms Run, near hickory tree, on big rock; chisel mark	833.67
Cutlips, in southwest corner of cut-stone foundation of church; aluminum tablet stamped "851 Grafton" (elevation possibly 1 foot too high)	851.970

From mouth of Toms Run west along highway via Hope to Perkins.

Hope post-office, on stone foundation of old log stable; chiseled square	989.274
Hope, 1.4 miles southwest of, east of road fork at mouth of Leopard Run, in southwest corner of stone foundation to house occupied in 1903 by John Seal and owned by C. F. Gerwig; aluminum tablet stamped "861 Grafton"	861.663
Progress, 1 mile northwest of, near mouth of Piper Fork on Crooked Fork, at forks of road, on stone foundation of schoolhouse, at southwest corner; chiseled square	868.14
Perkins, to right of road at forks, on large stone; chiseled square	771.55

SUTTON SPECIAL QUADRANGLE.

From Heaters south along Baltimore & Ohio R. R. to Sutton, thence along highway and across country to Birch River.

Feet.

Shaversville (Flatwoods post-office), Dr. B. M. Squire's drug store, 0.8 foot west and 3.5 feet south of northwest corner; iron post stamped "1071 Grafton"..................1070.810

Flatwoods, 1.6 miles south of, northeast corner of south abutment of railroad bridge 64 B; chiseled square............1051.95

Sutton, 2.3 miles north of (3.7 miles south of Flatwoods), on northeast corner of south abutment of railroad bridge 66D; chiseled square.................................... 863.28

Sutton, at suspension bridge over Elk River, in north face of north tower, 0.9 foot above foundation and 2.4 feet east of corner; bronze tablet stamped "843 Grafton"........... 842.677

Little Birch, 2 miles west of, 160 feet northwest of Bear Run, 50 feet northwest of road forks, north of road in outcrop of rock; bronze tablet stamped "1073 Grafton"..........1072.775

Birch River, 300 feet north of post-office, 0.2 mile south of mouth of Powell Creek on east side, opposite Ivan Brothers and Brown's store, in outcrop of rock; aluminum tablet stamped "1108 Knwa"............................1108.565

From Birch River eastward along highway to Erbacon, thence north along Baltimore & Ohio R. R. to Gillespie.

Birch River post-office, 3 miles east of, 150 feet west of Birch Valley schoolhouse (No. 24), 170 meet east of ford, north of river and road, in east end of large boulder; aluminum tablet stamped "1186"..................................1186.291

Waggy post-office, 0.5 mile west of, south of ridge road, 300 feet west of tram road and water tank. 0.3 mile east of road forks, in boulder; aluminum tablet stamped "2085".2084.728

Waggy post-office, 1 mile east of, north of county road, south of tram road, near summit, 0.4 mile from where tram road leaves ridge road, in outcrop of rock; aluminum tablet stamped "2176"..................................2176.059

Erbacon, 100 feet east of post-office, 100 feet south of station, in abutment at northwest end of Baltimore & Ohio bridge over mouth of Missouri Creek; aluminum tablet stamped "1518" 1517.854

Defoe, in front of station; top of rail........................1401

Erbacon, 2.7 miles north of, east of railroad, 0.1 mile north of Defoe station, 150 feet south of milepost 81, in top of stone culvert; aluminum tablet stamped "1373".........1373.151

Erbacon, 3.7 miles north of, west of railroad, east of Laurel Creek, 150 feet south of milepost 80, on outcrop of sand rock; chiseled square, marked "1286"..................1285.97

Erbacon, 4.7 miles north of, west of railroad, 200 feet south of milepost 79, on sand rock; chiseled square, marked "1203" 1203.03

	Feet.
Prestonia post-office, 0.1 mile north of, near mouth of Brooks Run, in top stone of abutment to railroad bridge over Laurel Creek; aluminum tablet stamped "1137"	1137.121
Centralia, 400 feet south of post-office, opposite G. E. & H. A. Hyer's store, 40 feet south of railroad crossing, 400 feet south of station, 20 feet east of railroad, 0.1 mile south of mouth of Laurel Creek, in stone culvert; aluminum tablet stamped "945"	944.819
Centralia, 1.1 miles north of, east of railroad, west of Elk River, opposite rock cliff, 200 feet south of milepost 48, on outcrop of sand rock; chiseled square, marked "952"	951.71
Bakers Run, 1 mile north of, west of railroad, 150 feet south of house, opposite mouth of Holly River, in outcrop of sand rock in bank; aluminum tablet stamped "943"	942.686
Bakers Run, 2 miles north of, south of railroad and river, 1 mile east of Holly River Junction, on outcrop of sand rock; chiseled square, marked "914"	913.30
Gillespie station, 0.5 mile south of, 40 feet south of milepost "C 69 & R 53," east of railroad, west of county road, 430 feet north of road crossing, in east end of culvert; aluminum tablet stamped "890"	889.865
Gillespie, in front of station; top of rail	890
Gillespie, 0.5 mile north of, on edge of county road near summit, on outcrop of sand rock, chiseled square; marked "930"	929.99
Gillespie, 1.2 miles northwest of, west of trail, opposite field, 0.2 mile south of house, on outcrop of rock, chiseled square; marked "886"	885.40
Gillespie, 2.2 miles northwest of, west of trail, on top of summit 0.5 mile west of house, in rock cliff; aluminum tablet stamped "945"	944.475

From point near Removal west along West Virginia Midland R. R. to Bakers Run.

Fuccy, ¼ mile southeast of, along highway, in boulder 10 feet west of road, west of fence; bronze tablet stamped "962"	961.652
Irwin, 0.3 mile west of, in rock north margin of track; bronze tablet stamped "924"	924.663

CRAWFORD QUADRANGLE.

From Ireland along highway south to Ingo.

Ireland, 0.7 mile south of, 10 feet east of railroad, 15 feet northeast of road crossing; chiseled square on boulder, marked "1242"	1241.77
Duffy, 250 feet northeast of church and schoolhouse, 60 feet north of road at forks south, in boulder in field; bronze tablet stamped "1208"	1207.399
Duffy, 1 mile south of, 10 feet south of stream crossing, on large boulder 4 feet east of road; chiseled square marked "1065"	1064.58

	Feet.
Duffy, 2.1 miles south of, at Bablin, in west side of concrete bridge over Glady Fork at mouth; bronze tablet stamped "998"	997.130
Duffy, 3.1 miles southeast of, 2 feet north of road; chiseled square on rock ledge, marked "1090"	1089.12
Ingo, at forks of road, 10 feet east of store; chiseled square on large boulder, marked "1038"	1037.28

GASSAWAY QUADRANGLE.

From point near Sutton west along highway to Gassaway, thence southwest along Coal & Coke R. R. to Otter.

Sutton, 3 miles west of, 0.2 mile west of Buffalo Ford, 800 feet east of old sawmill, in abutment of small bridge over Mud Run; aluminum tablet stamped "822"	821.914
Gassaway, 0.5 mile east of, in second stone of abutment, at northeast end of railroad bridge over Elk River; aluminum tablet stamped "839"	839.002
Gassaway, in front of station; top of south rail	833.7
Gassaway, 0.5 mile west of, south of railroad, at end of yard limit, on sandstone in culvert over run; chiseled square, marked "831"	831.21
Gassaway, 1.5 miles west of, south of railroad and Elk River, on doorstep of house; chiseled square, marked "833"	832.71
Gassaway, 2.6 miles west of, south of railroad and Elk River, 0.3 mile south of sawmill, in outcrop of sand rock; aluminum tablet stamped "831"	831.193
Gassaway, 3.6 miles southwest of, south of railroad and Elk River, 70 feet east of hollow, on outcrop of sand rock; chiseled square, marked "829"	828.64
Gassaway, 4.6 miles southwest of, south of railroad and Elk River, 0.1 mile west of road crossing on rock cliff; chiseled square, marked "825"	824.63
Gassaway, 5.6 miles southwest of, west of railroad and Elk River, 200 feet from mouth of Lower Rockcamp Run, opposite sawmill, in outcrop of rock; aluminum tablet stamped "825"	825.193
Gassaway, 6.6 miles west of, north of railroad and south of Elk River, on outcrop of sand rock; chiseled square marked "823"	822.35
Frametown, 200 feet south of post-office, in southeast abutment of county iron bridge over Elk River; aluminum tablet stamped "817"	816.582
Frametown, 1 mile west of post-office, 0.2 mile north of Rockton station, east of railroad and Elk River, on rock cliff; chiseled square, marked "817"	817.14
Rockton, 1.9 miles south of, southeast of railroad and river, in outcrop of sand rock; aluminum tablet stamped "813"	812.612
Glendon, 0.5 mile south of post-office, on southwest abutment of railroad bridge over Birch River; chiseled square, marked "811"	810.34

	Feet.
Glendon, 1.9 miles south of, southeast of railroad, near bend, on outcrop of sand rock; chiseled square, marked "806".	806.09
Strange Creek post-office, 200 feet north of station, in northeast abutment of railroad bridge over mouth of Strange Creek; aluminum tablet stamped "807"	806.653
Strange Creek post-office, 1 mile west of, north of railroad, near bend, south of river, on outcrop of sand rock; chiseled square, marked "807"	807.12
Villa Nova, 140 feet north of store and station, opposite house, west of railroad, east of river, in southwest corner of culvert; aluminum tablet stamped "787"	787.088
Villa Nova, 1.6 miles southwest of, south of railroad, 250 feet east of Frame Run, on rock cliff; chiseled square marked "795"	794.34
Ira, 0.5 mile west of post-office, 250 feet south of station, in northeast abutment of railroad bridge over mouth of Grove Run; aluminum tablet stamped "788"	787.900
Ira, 1 mile southwest of, west of railroad, east of river, 300 feet north of sawmill and hollow to west, on rock boulder, chiseled square; marked "784"	784.16
Ira, 2.1 miles southwest of, on southeast abutment of bridge over Jumping Gut; chiseled square, marked "780"	779.87
Ira, 3.1 miles southwest of, in top of stone in south end of culvert; aluminum tablet stamped "772"	771.627

From Strange Creek southeast to Birch River post-office.

Strange Creek post-office, 1 mile southeast of, 50 feet east of road crossing, 300 feet east of Upper Mill Creek, 100 feet east of road forks, on outcrop of sand rock, chiseled square, marked "818"	818.30
Strange Creek, 2 miles southeast of, south of road in bank, 180 feet west of road crossing, opposite house and hollow, in outcrop of sand rock; aluminum tablet stamped "879"	878.883
Jennings, 0.5 mile east of post-office, west of railroad, on edge of creek, at west end of trestle, on rock, chiseled square, marked "898"	897.66
Jennings, 2.4 miles southeast of, east of railroad, north of Strange Creek, 70 feet south of house, opposite hollow between trestles, in outcrop of sand rock; aluminum tablet stamped "993"	993.259
Jennings, 3.6 miles southeast of, 100 feet north of Trace Fork at mouth, east of railroad and creek, on sand rock; chiseled square, marked "1044"	1043.13
Jennings, 4.6 miles northeast of, east of road, 300 feet south of road to west, on sand rock; chiseled square, marked "1223"	1222.78
Jennings, 5.5 miles southeast of, between Ball schoolhouse and New Hope Church, 10 feet south of road fork, 300 feet west of Morris's store, in hollow between Hughes Mountain and Kenna Mountain, in outcrop of sand rock; aluminum tablet stamped "1253"	1252.955
Jennings, 7.6 miles southeast of, 0.5 mile east of Big Birch Ford, opposite hollow to right, north of river, on outcrop of sand rock; chiseled square, marked "1106"	1105.36

From Ivydale southeast to Buffalo Creek.

	Feet.
Ivydale, 3.2 miles southeast of, on ridge from Ivydale to Buffalo Creek, northeast of road, in large stone; aluminum tablet stamped "1308" (this elevation may be a foot too great)	1306.559
Ivydale, 4.4 miles southeast of, east side of road, on ledge; chiseled square	1299.27

From Frametown northwest to mouth of Joes Fork of Steer Creek.

Frametown, 0.5 mile north of post-office, southwest of road, on edge of bank, 0.5 mile north of mouth of Big Run, 100 feet west of Big Run schoolhouse, on sand rock; chiseled square, marked "827"	827.21
Frametown, 3.3 miles northwest of, south of run, north of road, 100 feet east of private road to north, 300 feet west of old store, on small rock; chiseled square, marked "977"	977.03
Dessie, 0.5 mile northeast of post-office, 130 feet northwest of road forks, 200 feet east of Joes Fork at mouth, 10 feet west of foot log, opposite hollow, in outcrop of sandstone; aluminum tablet stamped "908"	908.053

HACKER VALLEY QUADRANGLE.

From Bablin south along highway to Bois.

Bablin, 1 mile south of, at junction of Little Kanawha River and Wildcat Creek, in west side of north end of wire footbridge; copper nail "972.6"	972.33
Wildcat post-office, 400 feet east of, in rock north side of road; chiseled square, painted "950.2"	949.84
Bois post-office, at south side of ford of Right Fork of Little Kanawha River, in boulder; bronze tablet stamped "1079"	1079.147
Bois post-office, 1.6 miles south of, in gap at head of Williams Camp Run, in root of oak, south side of road; copper nail, painted "1611.5"	1611.31
Bois post-office, 2 miles south of, east margin of road in rock; chiseled square, painted "1513.9"	1513.65

OTTER QUADRANGLE.

From Minnora southeast along road to point 4 miles south of Big Otter, thence west via Newton to Amma.

Minnora, 4.5 miles south of, west of road, 30 feet northeast of house, at sharp bend in road, in pointed rock; aluminum tablet stamped "835"	834.862
Stinson, 2 miles northeast of, 200 feet northeast of house, south of road at bend to south, on Stinson Creek, in large boulder; aluminum tablet stamped "921"	920.195

	Feet.
Nebo, 1.8 miles south of post-office, west of road, 400 feet southwest of house, 600 feet west of deep hollow, in outcrop of cliff; aluminum tablet stamped "868"	867.766
Steer Run, 400 feet northwest of mouth of, north of road up left-hand fork of Rush Run (emptying into Otter Creek), in outcrop of rock; aluminum tablet stamped "950"	949.451
Newton, 4.4 miles southeast of, north of road, near mouth of Summers Fork, in rock cliff; aluminum tablet stamped "773"	772.471
Newton, 2.4 miles southeast of, north of road, 890 feet north of Cutoff Run, 150 feet east of Right Fork of Big Sandy Creek, 3 feet above level of road, in sandstone ledge; aluminum tablet stamped "746"	745.406

From Big Otter southeast to mouth of Dog Run on Buffalo Creek.

Big Otter, 5 miles south of, 1.2 miles south of mouth of Rush Run, east of road, 250 feet northeast of house, in hollow across Otter Creek, in rock; aluminum tablet stamped "798"	797.662
Ivydale post-office (Otter station), in southeast pier of iron suspension county bridge across Elk River; aluminum tablet stamped "758"	757.459

From Rand east along Coal & Coke R. R. to King.

Rand, 0.12 mile east of, 0.74 mile west of King, 10 feet south of Coal and Coke R. R. track, inside of wide curve near fill and deep hollow to south, in sandstone outcrop; aluminum tablet stamped "654"	654.068
King, in front of station; top of rail	653.6

SUMMERSVILLE QUADRANGLE.

Birch River, about 300 feet north of post-office, east of Powell Creek, about 0.25 mile north of mouth of Powell Creek, opposite Ivan Bros. & Brown's store, in outcrop of rock; aluminum tablet stamped "1108 Knwa"	1108.565

From Muddlety northwest along road to Buffalo Creek, thence north to Low Gap (leveled twice).

Muddlety, 7.3 miles northwest of, at crossing, about 2,000 feet north of Beech Fork, south of road, opposite Liberty Bowl Schoolhouse, in rock, aluminum tablet stamped "1747" Knwa"	1747.365
Liberty Bowl Schoolhouse, 1.3 miles northwest of, west side of road in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M."	1774.01

	Feet.
Liberty Bowl Schoolhouse, 3.1 miles northwest of, 300 feet east of Ed. Hamrick's store, north side of road, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M."	1700.54
Cressmont, 3.4 miles southeast of, north side of road, on ledge; chiseled square	1376.05
Cressmont, 2.3 miles southeast of, about 0.34 mile south of Blankenship's store, west side of road, in large boulder; bronze tablet (not stamped)	1062.537
Cressmont, 1.2 miles southeast of, east side of road, in root of stump; copper nail with washer stamped "U. S. G. S. W. Va. B. M."	923.30
Cressmont, about 250 feet south of railroad crossing, west side of road, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M."	822.90
Enoch, 3.8 miles northwest of, northwest side of Buffalo Creek, opposite point 60 feet north of mouth of Dog Run, in rock cliff; edge of hole in rock	826.644
Enoch, 3.8 miles northwest of, northwest side of Buffalo Creek, 90 feet north of Dog Run, in boulder; aluminum tablet stamped "828" (reported destroyed 1913)	827.104
Ivydale post-office, 9.1 miles southeast of, 1.1 miles northwest of mouth of Dog Run, west of sawmill, northeast of road, in top of large boulder; aluminum tablet stamped "857"	856.314
Ivydale, 7.7 miles southeast of, east side of road, on ledge; chiseled square	1070.61
Ivydale, 6.5 miles southeast of, west side of road, from Ivydale to Cressmont, 80 feet north of forks of road to Clay, in ledge; bronze tablet stamped "1352"	1352.190
Ivydale, 5.8 miles southeast of north of road from Sutton to Clay, on northeast slope of hill, south of Low Gap, in rock outcrop; aluminum tablet stamped "1236" (reported in 1915 as "Removed," but hole probably remains)	1234.610
Ivydale, 5.6 miles southeast of, west side of road, on ledge; chiseled square	1258.21

CLAY QUADRANGLE.

From King east along Coal & Coke Ry. to Upper Leatherwood (unadjusted line closing 1 foot low at Upper Leatherwood).

King Station, 0.44 mile east of, 1.18 miles west of Procious post-office, 10 feet north of railroad, on large sandstone boulder; chiseled square marked "665"	654.71
Camp, in front of station; top of rail	652.7
Procious (Camp station), 0.35 mile east of post-office, 3.91 miles west of Shelley Junction station, 10 feet south of railroad, on short tangent, nearly opposite frame dwelling of Mr. Walker, on sandstone boulder; chiseled square, marked "655"	654.93
Procious, 0.97 mile east of, 3.29 miles west of Shelley Junction station, 12 feet south of railroad, along long tangent, 1,500 feet east of point opposite dwelling house on north of track, in sandstone outcrop; aluminum tablet stamped "658"	657.624

	Feet.
Shelley Junction, 0.91 mile west of, 10 feet south of railroad, inside of long, sharp curve, nearly opposite mouth of creek on north side of river, on large sandstone boulder; chiseled square, marked "665"	664.83
Shelley Junction, 0.39 mile west of, 10 feet southwest of railroad, on 1,000-foot tangent, 380 feet west of switch near Shelley Junction, nearly opposite mouth of Big Laurel Creek, in sandstone outcrop; aluminum tablet stamped "666"	665.965
Angeline, in front of station, top of rail	665.4
Angeline, 1.08 miles east of post-office, 1.07 miles west of Birch station, 30 feet south of railroad, just west of long, sharp curve in track, on sandstone boulder; chiseled square, marked "667"	666.20
Birch, in front of station, top of rail	670.1
Eldorado, 2.03 miles west of post-office, 30 feet south of railroad, on outside of long curve, 250 feet east of railroad crossing, in a sandstone outcrop; aluminum tablet stamped "679"	678.262
Shelton, in front of station, top of rail	674.1
Big Sycamore, in front of station (**Eldorado post-office**), top of rail	676.1
Dorfee, in front of station; top of rail	677.2
Dorfee, 1 mile east of station, 1.02 miles west of Elkhurst station, 10 feet south of railroad, along short tangent, 380 feet east of point opposite dwelling on north of track, in sandstone outcrop; aluminum tablet stamped "682"	681.774
Elkhurst, in front of station; top of rail	683.82
Yankee Dam, 0.54 mile east of post-office, 3.4 miles west of Leatherwood station, 10 feet north of railroad, 100 feet west of south end of suspension tram bridge over Elk River to sawmill, on solid sandstone boulder, chiseled square; marked "690"	689.61
Yankee Dam, 1.07 miles east of post-office, 2.33 miles west of Upper Leatherwood station, 12 feet south of railroad on short tangent, at mouth of small hollow to right, at west end of small fill, in solid sandstone boulder; aluminum tablet stamped "697"	696.724

From Upper Leatherwood east along Coal & Coke Ry. to Clay, thence southeast along Buffalo Creek & Gauley R. R. to mouth of Sand Fork.

Upper Leatherwood, 200 feet west of station, in north end of east abutment to three-span, plate-girder bridge over Leatherwood Creek; aluminum tablet stamped "702"	702.333
Leatherwood station, 1 mile east of (2.07 miles west of Clay), 12 feet south of railroad on short tangent, just east of long curve, nearly opposite deep hollow north of river, on sandstone outcrop, chiseled square; marked "705"	705.80
Clay, corner of Main and Church streets, 10 feet west of northwest corner of Clay County Bank, in monument; bronze tablet stamped "707"	707.816

	Feet.
Clay, 1.02 miles east of post-office, 1.88 miles north of Avoca post-office, on north end of capstone of east pier of Queen truss railroad bridge across Buffalo Creek near mouth; chiseled square, marked "707"	708.13
Avoca, in front of station and post-office; top of rail	721.4
Avoca, 0.35 mile south of post-office, 5.05 miles north of mouth of Sand Fork, 10 feet east of Buffalo Creek & Gauley R. R. track, on outside of deep curve in railroad and creek, 40 feet east of creek, near bottom of very thick sandstone outcrop; aluminum tablet stamped "725"	725.660
Avoca, 1.29 miles south of post-office, 4.02 miles north of mouth of Sand Fork, 10 feet north of Buffalo Creek & Gauley R. R. track, at west end of deep side-hill cut in sandstone, 50 feet north of creek, on sandstone outcrop; chiseled	
Sand Fork, 2.13 miles north of mouth, 10 feet east of Buffalo Creek & Gauley R. R. track, on outside of heavy curve of creek and track, 40 feet east of creek, near south end of heavy side-hill excavation in stone, 1,200 feet north of point opposite schoolhouse, at bottom of thick sandstone outcrop; aluminum tablet stamped "771"	772.094
Sand Fork, 1.1 miles north of mouth, on outside of heavy curve in track, 10 feet east of track, 60 feet east of creek, near bottom of thick sandstone outcrop; chiseled square marked "787"	787.73

From Upper Leatherwood south via Leatherwood and Twentymile Creeks to Belva.

Morocco, in front of post-office; top of rail	714.7
Morocco, 0.48 south of post-office, 10 feet east of track, 800 feet south of large sawmill, near house and hollow on left, on large white sandstone boulder; chiseled square, marked "732"	732.27
Morocco, 2.11 miles south of, 20 feet east of railroad, 500 feet north of small hollow to west, in large sandstone boulder under cedar tree in west edge of creek; aluminum tablet stamped "798"	798.667
Morocco, 5.58 miles south of, 200 feet west of railroad, 300 feet south of residence of J. A. Summers, 400 feet south of mouth of Henrys Branch to east, in west margin of creek, in flat sandstone boulder; aluminum tablet stamped "919"	919.848
Morocco, 8.56 miles south of, 30 feet west of county road, about one-third way to top of hill on road from Leatherwood Creek to Twentymile, at Clay-Nicholas County Line, in solid sandstone boulder, among the roots of large leaning beech tree; aluminum tablet stamped "1266"	1266.997
Vaughan, 7.73 miles northeast of, 12 feet east of edge of creek at road crossing, 600 feet north of mouth of Boardtree Branch, on sandstone boulder; chiseled square, marked "1019"	1020.40
Boardtree Branch, 0.82 mile west of mouth, 6.78 miles northeast of Vaughan post-office, 10 feet east of narrow-gage railroad track, 30 feet east of creek in sharp bend of stream, on outside of long curve in railroad track, in rock; aluminum tablet stamped "993"	994.234

	Feet.
Boardtree Branch, 2.82 miles west of, 4.88 miles northeast of Vaughan post-office, 20 feet south of track, at north edge of county road at creek crossing, in root on north side of leaning white-oak tree; spike, marked "929" (elevation 7.8 feet above low water at crossing)	929.93
Vaughan, 3.8 miles northeast of, 10 feet north of railroad, 300 feet north of county road, 350 feet north of creek, in solid inclined sandstone boulder; aluminum tablet stamped "904"	905.517
Vaughan, 1.59 miles northeast of, 10 feet north of railroad, 40 feet north of sharp curve in creek, near road crossing, 600 feet west of point opposite dwelling, 2 feet below coal horizon, on sandstone outcrop; chiseled square marked "860"	860.97
Vaughan, 0.22 mile east of post-office, at upper side of county road, 50 feet north of mouth of hollow extending northeast to Walker Knob, near north end of lumber yard in Vaughan, 30 feet north of Chesapeake & Ohio Ry. track, sandstone outcrop; aluminum tablet stamped "810"	811.034
Vaughan, 0.8 mile southwest of, in north edge of creek, 20 feet south of Chesapeake & Ohio Ry., 150 feet north of county road, 1,200 feet east of milepost marked "G-12" on east side and "G-13" on west, on large boulder; chiseled square. marked "789"	790.32
Vaughan, 3.3 miles southwest of, in railroad cut, 10 feet north of railroad, opposite mouth of Dorsey Branch, 250 feet north of residence of C. D. Backus, in face of thick sandstone outcrop; aluminum tablet stamped "739"	740.668
Vaughan, 3.8 miles southwest of, 3.89 miles northeast of Belva station, 10 feet north of railroad, 60 feet north of creek and road, nearly opposite residence on south side of creek, 60 feet west of north end of wooden foot-bridge across Twentymile Creek, on sandstone outcrop; chiseled square, marked "725"	726.44

CLENDENIN QUADRANGLE.

From Clendenin east along Coal & Coke Ry. to Rand.

Clendenin, 0.33 mile north of, 600 feet north of dwelling, at upper side of road up Big Sandy Creek, on sandstone outcrop; chiseled square, painted "621"	620.70
Turner, in front of station; top of rail	636.2
Turner, 0.72 mile east of station, 1.1 miles west of Queen Shoals station, 12 feet south of tracks, nearly opposite west house in group of four, in brown sandstone boulder; aluminum tablet stamped "645"	643.991
Barren Creek, 0.26 mile west of post-office 20 feet south of track, opposite east end of warehouse near lampblack factory, on sandstone boulder; chiseled square marked "644"	643.45
Barren Creek, in front of post-office; top of rail	644
Porter, 0.82 mile west of station, 10 feet southwest of track, in blue sandstone outcrop; aluminum tablet stamped "646"	645.511
Porter, in front of station; top of rail	644.3
Porter, 0.4 mile east of station, 10 feet south of track, 300 feet east of house on opposite side of track, on brown sandstone boulder; chiseled square, marked "648"	647.91

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